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Examiners' Report
June 2014

GCE Biology 6BI01 01

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June 2014

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Introduction

This paper tested the knowledge and understanding of the two AS topics: 'Lifestyle, health and risk' and 'Genes and health', together with elements of How Science Works. The range of questions provided plenty of opportunity for candidates to demonstrate their grasp of these AS topics. The paper appears to have worked very well with all bar a few questions (for example some of the multiple choice 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.

It was pleasing to see that many candidates have learnt from previous papers and reports and there are fewer examples of 'amount', some candidates quoted figures when describing trends and stated ratios when asked for a probability. Unfortunately, too many candidates did not read the questions carefully and happily tried to answer a question that they hoped had been asked e.g. describing transcription instead of translation. Some candidates lost marks through poor literacy; others through carelessness, for example, not making a clear comparative statement or only making one clear statement when a question carries two or more marks. A significant number of candidates restated information given in the question at times and therefore failed to gain credit for those responses.

Having said this, there were large numbers of excellent responses; often being concise, clear and comprehensive, showing a good use of technical terms and biological names.

The multiple choice questions:

1(a)(i) Approximately 2/3rds of the candidates recognised that phosphodiester bonds join nucleotides in mRNA molecules. The most common mistake was to choose hydrogen bonds.

(ii) Most of the candidates correctly chose 200 amino acids; 300 and 600 were the most common errors.

(iii) Only a small number recognised that there will be 0% thymine; 22% adenine and 28% uracil were the most common incorrect responses.

6(a)(i) and (ii) most candidates correctly interpreted the data from the graph to choose the correct response.

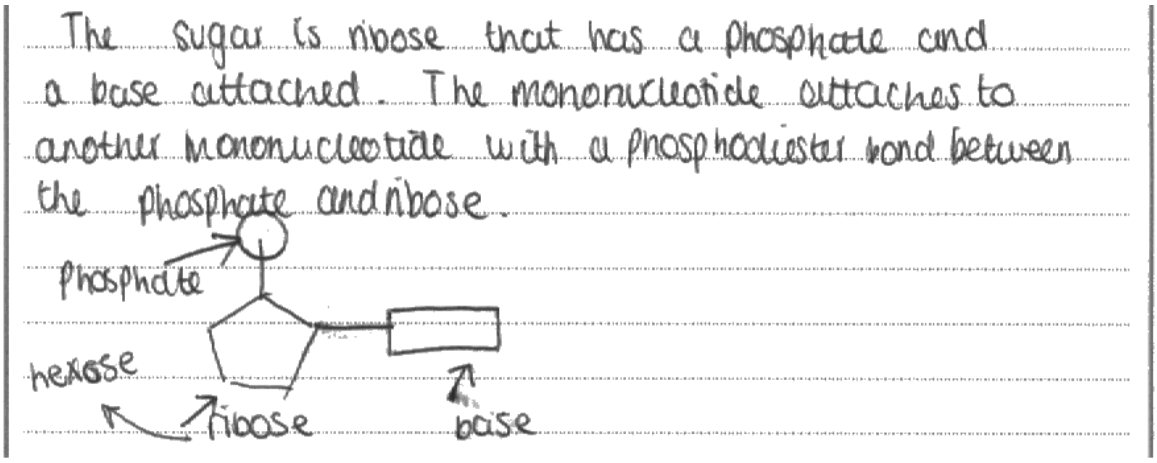
(iii) About half of the candidates determined the correct units for BMI. The most common error was to select kg m^2.

(iv) Approximately 75% of candidates recognised that reliability would be improved with a larger sample size. The most common errors were to choose female office workers, or more types of breakfast.

Question 1 (b)

Most candidates did well on this question. Where errors were made they confused the structure of a DNA nucleotide with an RNA nucleotide e.g. by naming deoxyribose and/ or including thymine as a possible base. A few candidates implied that one nucleotide had several bases attached to it, others described a base pair rather than the structure of a single base.

This response gains both marks available.



ResultsPlus
Examiner Comments

Although the diagram was not needed as both marks have been gained by the written response, the annotated diagram would also have gained the marks.

ResultsPlus
Examiner Tip

If you include a diagram in your response make sure you annotate it clearly or it will not gain any credit.

This response gains both marks available, but also shows some errors with the bonding.

A mononucleotide is made up of a po phosphate group, a sugar called ribose. and a base. Glycosidic bonds join these together. Hydrogen bonds join 2 bases together and phosphodiester bonds join the sugar and phosphate group together.

ResultsPlus
Examiner Comments

One mark gained for the phosphate and ribose and the other mark for the base. Glycosidic bonds are not involved, but this has not been penalised here.

This response gained one mark.

The mononucleotide in RNA is made of a pentose sugar called deoxyribose, a phosphate group and a base group. The base groups possible are ~~U which pairs with A or~~ U and A which pair together or C and G which pair together, if this is a T on the DNA strand then an Adenine will ~~become~~ be the base on the RNA

ResultsPlus
Examiner Comments

This response gained the mark for the base, but is an example of a common error where the structure of an RNA nucleotide and a DNA nucleotide has been muddled and they have included deoxyribose instead of ribose.

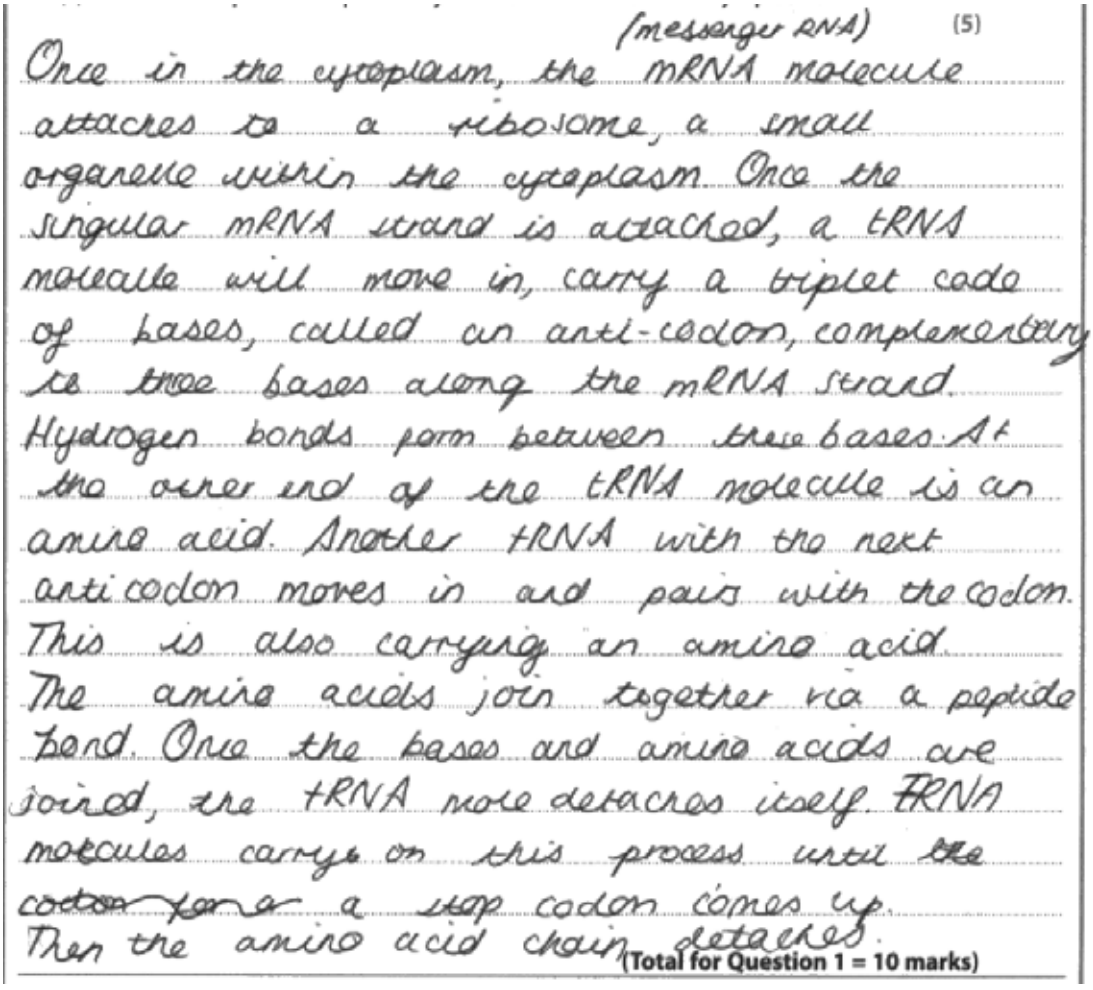
Question 1 (c)

This question achieved the full range of marks from 0 to 5, with equal proportions of candidates on each mark. Many candidates demonstrated a detailed and sound understanding of the process of translation writing a logical account with plenty of specific details e.g. the complementary base pairing between the codon and anticodon. Several candidates even managed to match all points on the mark scheme in the same sequence. The majority of candidates gained credit for recognising the role of ribosomes and that peptide bonds form between the amino acids, but several lost marks for careless wording e.g. a tRNA carries amino acid**s** (rather than just one).

Unfortunately, many candidates ignored the context stated in the question '*in the cytoplasm*' and therefore wrote in detail about transcription and only wrote a few comments about translation at the end such as the mRNA goes to the ribosome. Some other candidates included a significant amount of unnecessary detail about the structure and folding of proteins rather than how they were synthesised.

Some candidates appear confused about the relationship between tRNA, mRNA and amino acids and have tRNA being formed by replication of the mRNA and several candidates describe amino acids being formed/produced by the tRNA. A few candidates even described reverse transcription and had the mRNA making new DNA molecules in the ribosomes without mentioning proteins at all. There was some confusion with a few candidates over the types of bonds between bases, and those between amino acids. Some candidates stated that amino acids were bases.

This response gained all five marks available.



(messenger RNA) (5)

Once in the cytoplasm, the mRNA molecule attaches to a ribosome, a small organelle within the cytoplasm. Once the singular mRNA strand is attached, a tRNA molecule will move in, carry a triplet code of bases, called an anti-codon, complementary to three bases along the mRNA strand. Hydrogen bonds form between these bases. At the other end of the tRNA molecule is an amino acid. Another tRNA with the next anticodon moves in and pairs with the codon. This is also carrying an amino acid. The amino acids join together via a peptide bond. Once the bases and amino acids are joined, the tRNA molecule detaches itself. tRNA molecules carry on this process until the ~~codon for a~~ stop codon comes up. Then the amino acid chain detaches.

(Total for Question 1 = 10 marks)

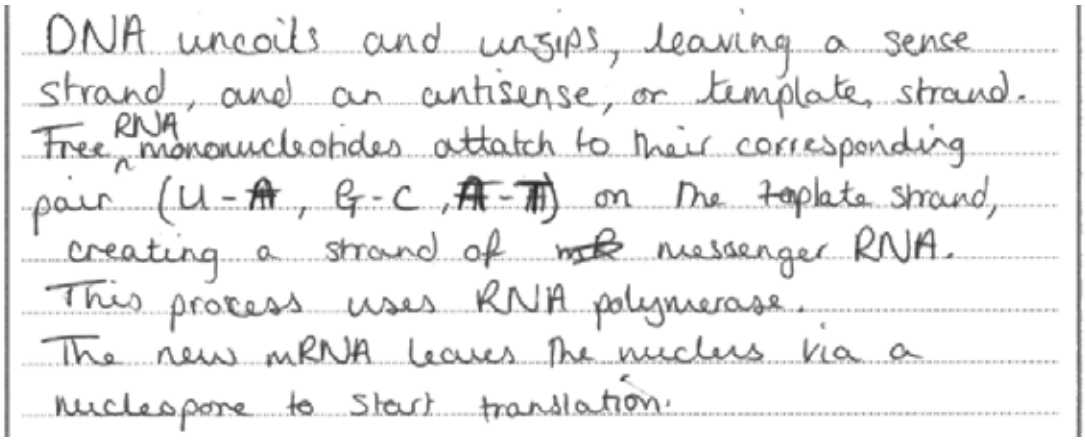
ResultsPlus
Examiner Comments

Marks were awarded for:
mRNA attaching to the ribosome;
anticodon and codon pairing between the tRNA and mRNA;
correct reference to the hydrogen bonding;
tRNA carrying an amino acid;
correct reference to the peptide bond;
tRNA being released;
correct reference to a stop codon.

ResultsPlus
Examiner Tip

For an extended description like this it helps clarity (and credit) if your response is written in a clear logical sequence like this response.

This response gained no marks.


DNA uncoils and unzips, leaving a sense strand, and an antisense, or template, strand. Free RNA mononucleotides attatch to their corresponding pair (U-~~A~~, G-C, ~~A~~-~~T~~) on the ~~t~~template strand, creating a strand of ~~mR~~ messenger RNA. This process uses RNA polymerase. The new mRNA leaves the nucleus via a nuclespore to start translation.

ResultsPlus
Examiner Comments

This is a typical response of the candidates who did not read the question and just described transcription and gave up just as they reached the description of translation.

ResultsPlus
Examiner Tip

Always read the question carefully to avoid silly mistakes. If the question asks you to describe what happens in the cytoplasm, don't just describe what happens in the nucleus.

This response gained two of the five available marks.

The DNA double helix unwinds, breaking the hydrogen bonds in the process. This is caused by DNA helicase.

One of the strands is used, called the antisence or ~~coding~~ template strand.

Free nucleotides line up, alongside, following complementary base pairings, forming mRNA.

mRNA then moves into the cytoplasm via ~~nuclear~~ nuclear pores.

The mRNA binds with a ribosome, either on a rough E.R or seperated in the cytoplasm. Then ~~RNA~~ translation occurs forming a protein.

tRNA ~~base~~ anti-codon matches up with triplet (codon) code on the mRNA, following complementary base pairing rules.

Then amino acids are formed.

ResultsPlus
Examiner Comments

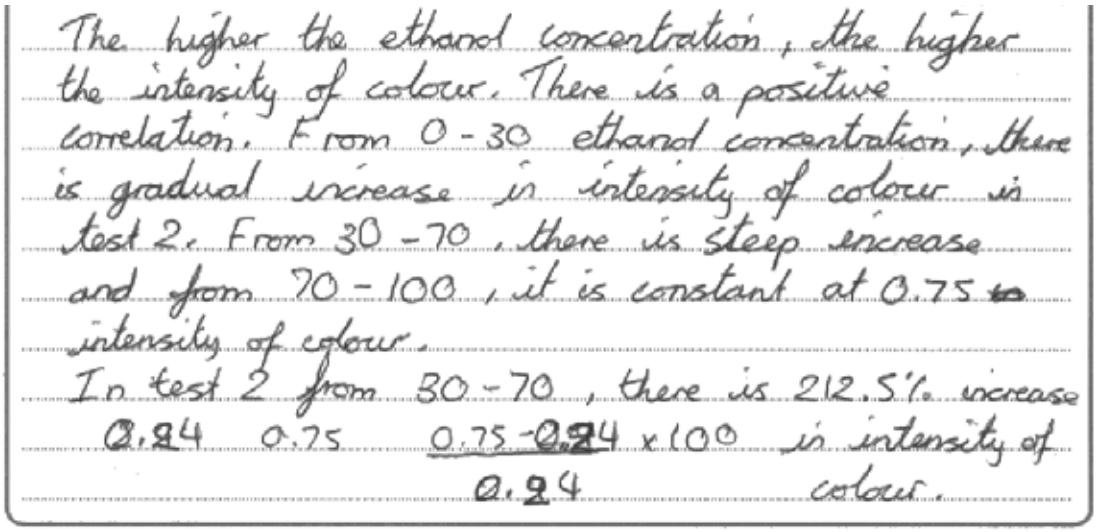
This response gained marks for the reference to the ribosome and the pairing of the mRNA and tRNA. This candidate is typical of many who think that amino acids are formed rather than arranged by the process of translation.

Question 2 (a)

Most candidates correctly stated the general trend shown in the graph. A significant number of candidates just stated data from the table, without manipulating it or making it expressly clear that this linked to a non-linear increase. A number of candidates made reference to speed / time in relation to the data. Many candidates did attempt manipulation of figures, rather than just quoting them. However, some misread the scale on the graph and used inaccurate values to give incorrect manipulated answers.

Many candidates failed to recognise that the intensities of colour for test 2 were consistently higher than in test 1, despite subsequent questions asking about this. Some candidates lost marks for confusing test 1 and test 2 when they were describing the non-linear trend or calculating the differences.

This response gained all three marks available.

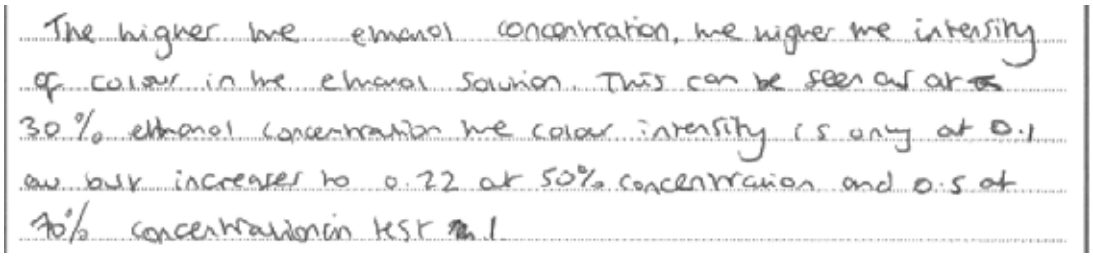

The higher the ethanol concentration, the higher the intensity of colour. There is a positive correlation. From 0 - 30 ethanol concentration, there is gradual increase in intensity of colour in test 2. From 30 - 70, there is steep increase and from 70 - 100, it is constant at 0.75 to intensity of colour.
In test 2 from 30 - 70, there is 212.5% increase
0.24 0.75 $\frac{0.75 - 0.24}{0.24} \times 100$ in intensity of colour.

ResultsPlus
Examiner Comments

One mark was awarded for the positive correlation; one for the description of the non-linear trend; and one mark for the manipulation of the figures.

Although this is a good response that gained full marks, candidates should ignore that there are two sets of data on the graph and a description of the effect on ethanol should compare both sets of data provided.

This response gained one of the three marks available.


The higher the ethanol concentration, the higher the intensity of colour in the ethanol solution. This can be seen as at 30% ethanol concentration the colour intensity is only at 0.1 as but increases to 0.22 at 50% concentration and 0.5 at 70% concentration in test 1

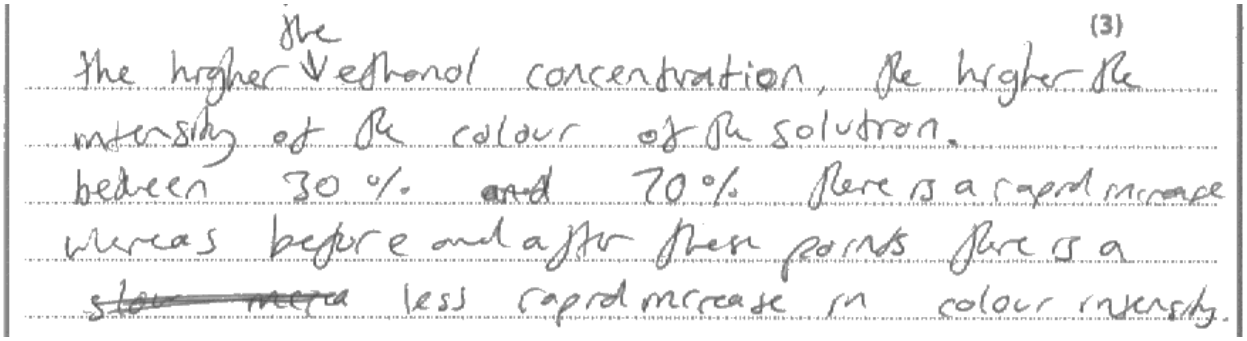
ResultsPlus
Examiner Comments

The overall trend has been correctly identified, but the candidate has just gone on to quote various points on the graph.

To gain credit for recognising that a trend is non-linear candidates need to clearly state what is happening at each stage, even if it is just a simple statement such as the greatest increase was between 30 and 70% ethanol.

With descriptions of data candidates will often be awarded marks for manipulating the figures (not just stating the data points) e.g. "there was a 0.1 increase (in the intensity of colour) between 0 and 30% ethanol concentration in test 1"

This response gained one of the three marks available.


(3)
The higher the ethanol concentration, the higher the intensity of the colour of the solution. between 30% and 70% there is a rapid increase whereas before and after these points there is a ~~slow~~ less rapid increase in colour intensity.

ResultsPlus
Examiner Comments

This candidate recognised the general trend, but in trying to describe the non-linear nature of the trend they ignored what was being measured and referred to rapid and less rapid changes.

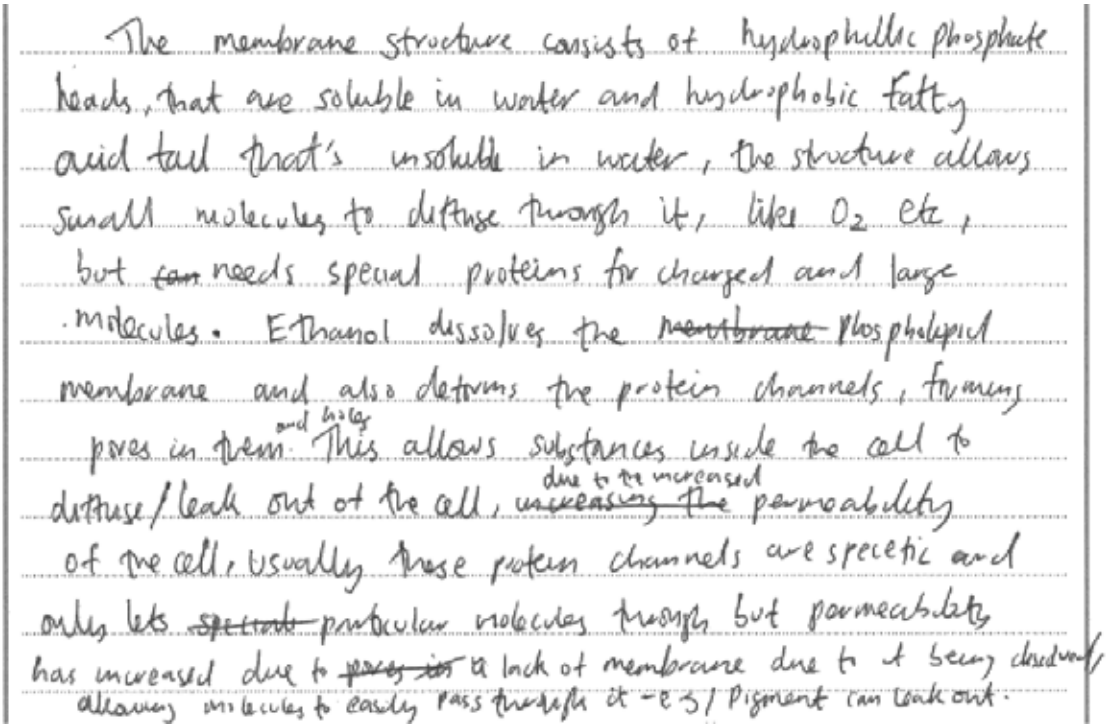
ResultsPlus
Examiner Tip

Always check the axis of a graph carefully for what is being measured. If there is no measurement of time then a description of an effect should not refer to time e.g. with use of words such as rapid, faster, slower, etc.

Question 2 (b)

Many candidates were able to simply explain that the membrane had been disrupted but many were unable to explain this further as to how this disruption takes place. Very few linked this to potentially denaturing membrane proteins but some were able to comment on ethanol dissolving lipids. Some candidates lacked some detail especially to do with comments on where the pigment is escaping from or stating that it escaped from the cell membrane. Few made any comments about the vacuole. Some candidates just commented on the increased permeability and used data from the graph to describe the trend shown by the graph, instead of explaining the effect. A significant number of candidates used osmosis or diffusion of the ethanol explanations in an attempt to explain what was happening. Some thought that the disruption was due to the pH of the ethanol.

This response gained all four available marks.



The membrane structure consists of hydrophillic phosphate heads, that are soluble in water and hydrophobic fatty acid tail that's insoluble in water, the structure allows small molecules to diffuse through it, like O_2 etc, but ~~can~~ needs special proteins for charged and large molecules. Ethanol dissolves the ~~membrane~~ phospholipid membrane and also deforms the protein channels, forming pores in them and holes. This allows substances inside the cell to diffuse/leak out of the cell, ~~increasing the~~ due to the increased permeability of the cell, usually these protein channels are specetic and only lets ~~special~~ particular molecules through but permeability has increased due to ~~pores in~~ a lack of membrane due to it being dissolved/ allowing molecules to easily pass through it - e.g/ Pigment can leak out.

ResultsPlus

Examiner Comments

Marks were awarded for:

disruption of the membrane (lack of membrane);

ethanol dissolves phospholipid;

ethanol deforms protein channels (an equivalent allowed for denaturing the protein);

pigment can leak out of the cell (pieced together across the response).

This response gained two of the four marks available.

Ethanol causes the membrane structure to break down and the phospholipid bilayer is no longer able to hold its contents, causing the colour intensity to increase. This is because the phosphate heads (hydrophilic) are broken down and the fatty acid tails are soluble in ethanol. This means the membrane is much more permeable as ethanol is added due to it being broken down.

ResultsPlus
Examiner Comments

This response is typical of those that recognise that the membrane is disrupted by the ethanol and that this is because the lipid tails are soluble in ethanol. No attempt is made to explain what is causing the colour intensity and the phosphate heads are not broken down.

This response gained no marks.

Ethanol breaks down the reaction which causes there to be a greater permeability which means more pigment is produced and the intensity of colour is greater, shown in the graph as as the ethanol concentration becomes greater the intensity of colour becomes greater showing that there is greater permeability when more ethanol is produced as it breaks it down. The temperature of 20°C also causes the molecules to more around more making it more permeable.

ResultsPlus
Examiner Comments

This is an example of the many responses that primarily gave the trend of greater permeability without explaining why it became more permeable. Some candidates also thought that the pigment is produced rather than released from the cell.

ResultsPlus
Examiner Tip

Make sure you know the difference between describe and explain type of questions.

Question 2 (c)

Most candidates gained at least one mark but many only made one point or made a good point followed by a general statement such as the variables weren't kept controlled, or restated one of the control variables already stated in the question e.g. temperature or using a different beetroot. Both of these should have been ruled out as possible answers if the information in the stem of the question had been read carefully.

Most candidates who gained both marks referred described that there would be damage to the cells and there was a need to rinse the pieces which could have caused the discrepancy in results. Although some did not make it clear which set of test results would have been affected by the error (or got the test wrong e.g. test 1 was left in ethanol for a longer time).

Some candidates made a correct reference to differences in the use of the colorimeter, e.g. calibration.

A few candidates just described the data suggesting that they had not read the question properly.

This response gains both marks available.

(c) Suggest why the results for these two investigations are different.

(2)

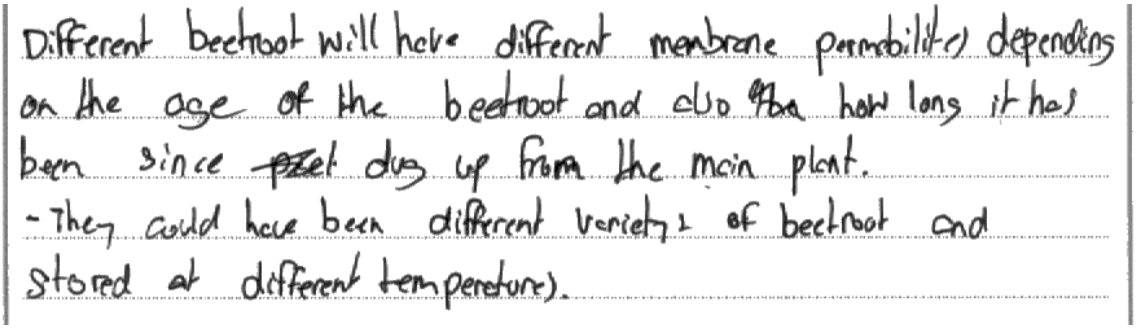
Test 2 was more accurate. ~~Test 4~~ In test 1, the beetroot were not washed or ~~dapp~~ dabbed/dryed properly. This means that when cutting, the ~~ve~~ cell was damaged and pigment leaked out of cell. causing innacurate result. ~~the experiment ma~~ ~~Test 4~~ Test ~~2~~ 2 did do this properly.
They may have done the two tests under different conditions. (unintentionally)

ResultsPlus
Examiner Comments

Marks were awarded for beetroot cells damaged when cutting and test 2 not being washed properly.

Although this gained full credit, be careful when suggesting that beetroot cylinders need to be dried before use as this can cause errors.

This response gained no marks.


Different beetroot will have different membrane permability depending on the age of the beetroot and also how long it has been since ~~pzel~~ dug up from the main plant.
- They could have been different variety of beetroot and stored at different temperature).

ResultsPlus
Examiner Comments

Different beetroots could cause differences in results, but the question stem clearly states that the 10 identical pieces used for test 1 and test 2 were cut from the same beetroot, so this is not a credible reason for the differences in the context of this investigation - so no credit given.

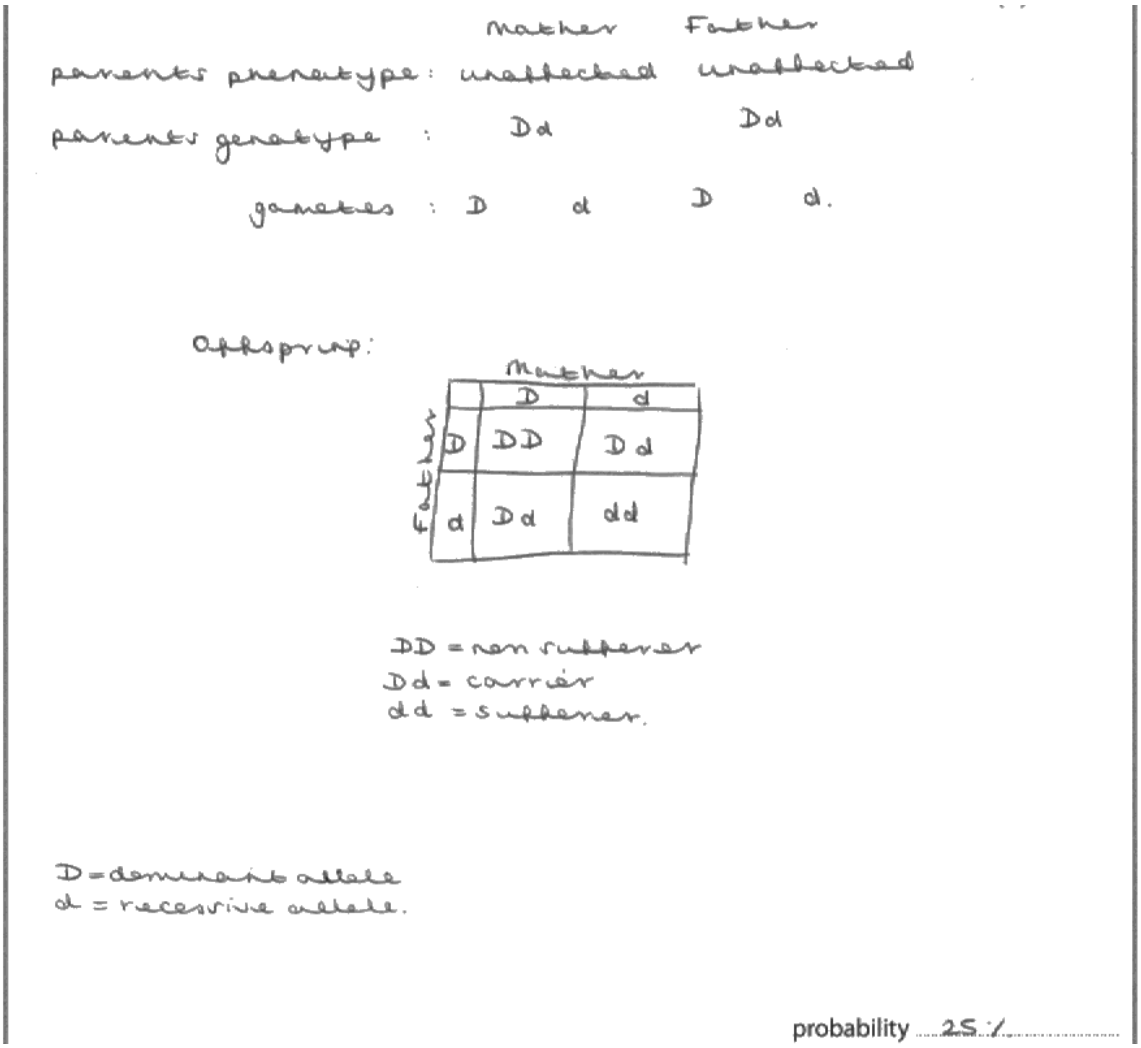
ResultsPlus
Examiner Tip

Read all of the information given in the question carefully to make sure you do not repeat information already given.

Question 3 (a)

Most candidates gained at least two marks by correctly drawing a Punnett square and identifying the resulting 25%. However, a much smaller proportion also identified the phenotypes of the potential offspring and even fewer clearly identified the genotype of the parents separately from the Punnett square. A few candidates thought that the probability would be 0, because the couple had already had an affected child. Thankfully very few candidates included a ratio as their answer instead of the requested probability.

This response gained all four available marks.



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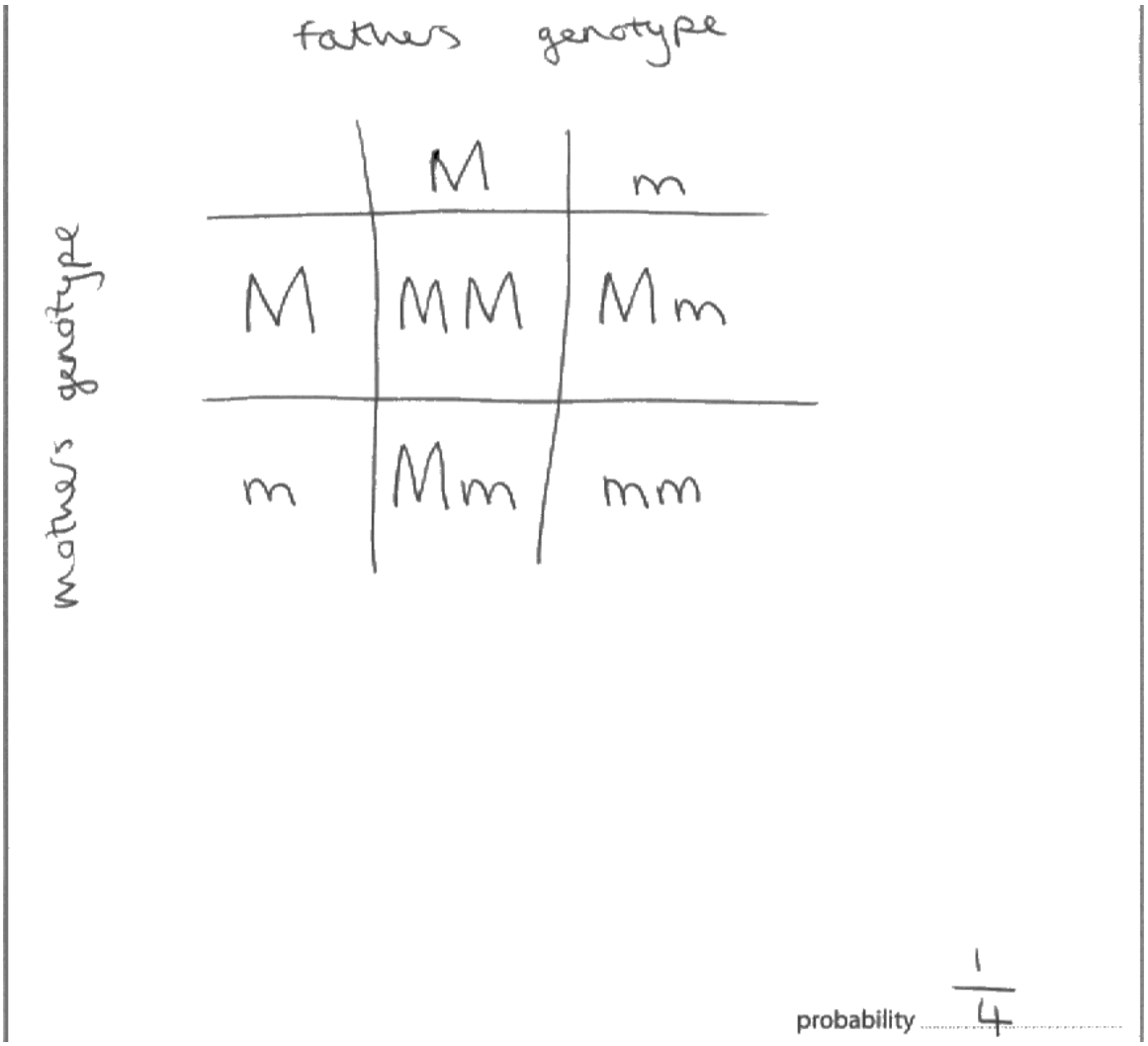
Examiner Comments

Marks were awarded for:
genotype and gametes of the parents clearly shown;
genotypes of the possible children clearly shown;
genotypes of the possible children clearly linked to the phenotypes;
probability correct.

This response gained two of the four marks available.



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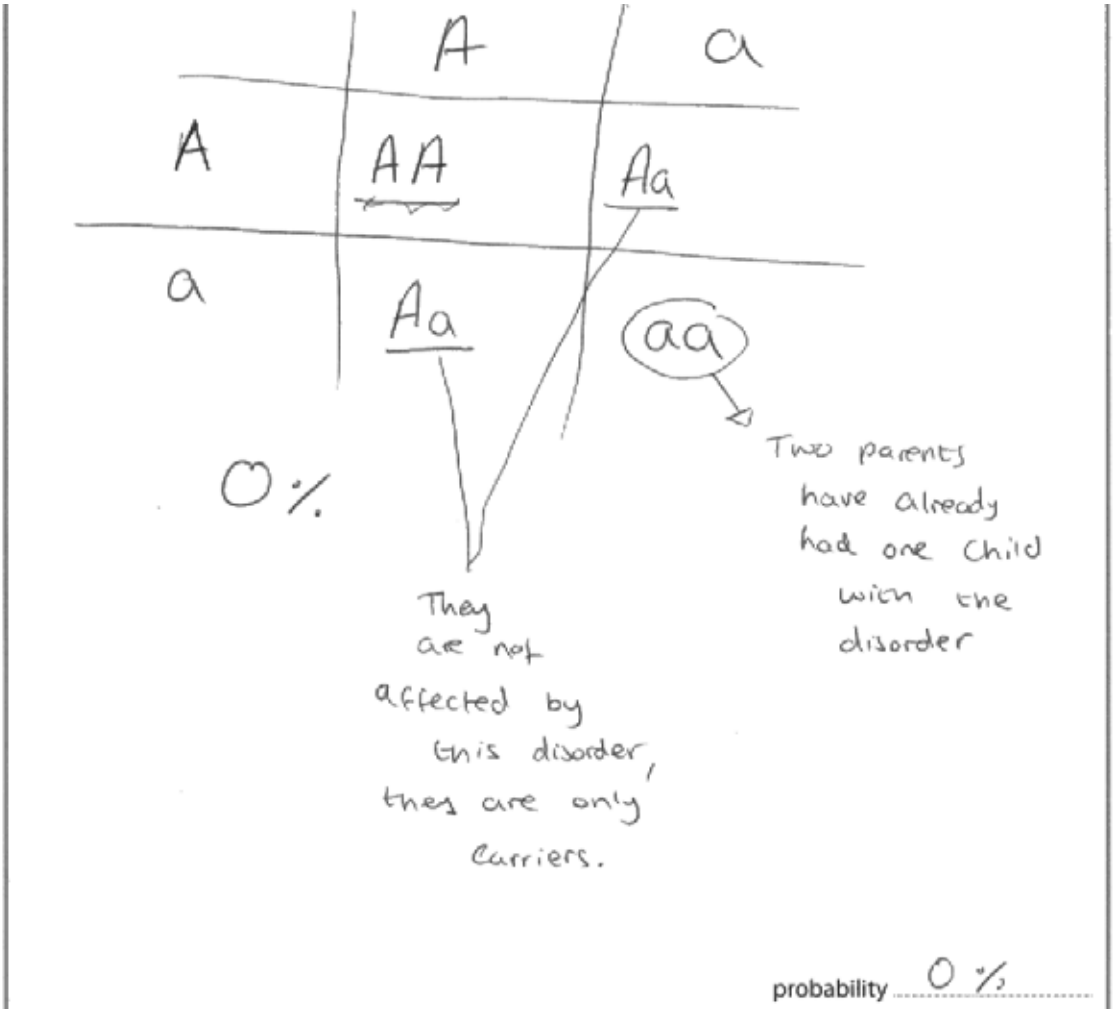
Examiner Comments

The Punnett square and resulting probabilities are both correct.

A full genetic diagram should ideally include clearly the parents' genotype - labelling the Punnett square as genotype is not sufficient as the Punnett square sets out the gametes from each parent.

It should also make it clear what phenotypes the possible resulting genotypes will cause.

This response gained one of the four marks available.



ResultsPlus
Examiner Comments

One mark was gained for the genotypes of the possible children being shown.

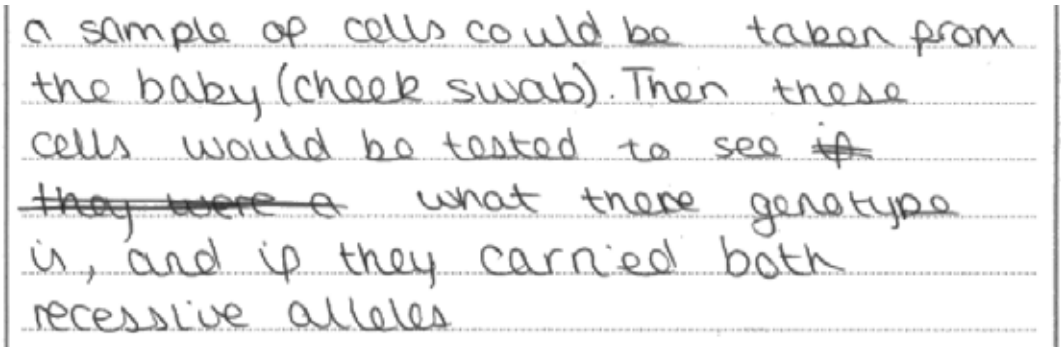
Just because the parents have already had one child who was affected the probability for each child will remain 25% and not fall to 0%.

Question 3 (b)

The most common correct answers involved getting cells via a mouth swab or blood test and many candidates gained a mark for testing for the MLD allele. Many candidates lost marks via stating Amniocentesis or Chorionic Villus Sampling as suitable techniques. Answers were even written this way with the words 'new born baby' included. Some candidates wanted to screen the parents rather than test the baby. Brain scans were also thought to be a good idea by some. Alleles and genes were occasionally being examined under a microscope.

Some candidates confused gene therapy and gene testing and therefore described the potential treatment rather than the diagnostic test.

This response gained both marks available.



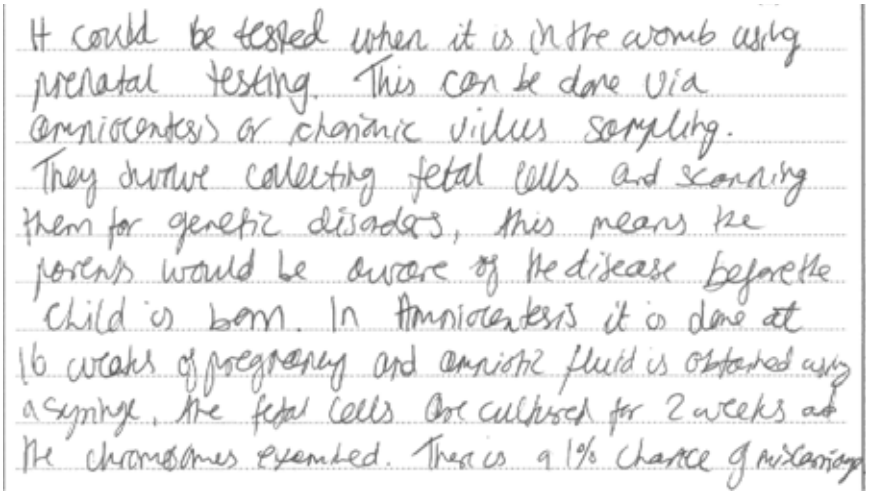
ResultsPlus

Examiner Comments

Marks were awarded for a suitable method of getting sample cells from the baby and recognising what you are looking for in the test.

Even though this response gained full marks, ideally it would also recognise that you would need to extract the DNA from the cells for testing.

This response gained no marks.



ResultsPlus
Examiner Comments

This response is typical of many that suggested using a prenatal test on a new born baby. Screening for genetic disorders is also not clear enough for credit at this level.

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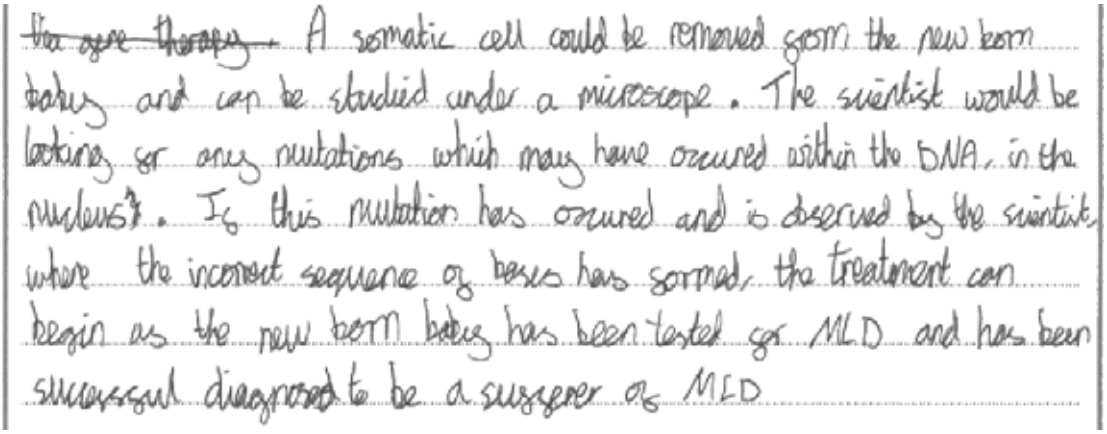
Examiner Tip

Read the question and context carefully when selecting which genetic screening test to use. Ask yourself whether the context relates to pre-implantation, prenatal (before birth), after birth, or screening of the parents.

This response gained no marks.



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Examiner Comments

This response has the context of what to test, but has not suggested how the somatic cell would be removed. MLD and mutations in the DNA are not clear enough to credit for what is being tested for.

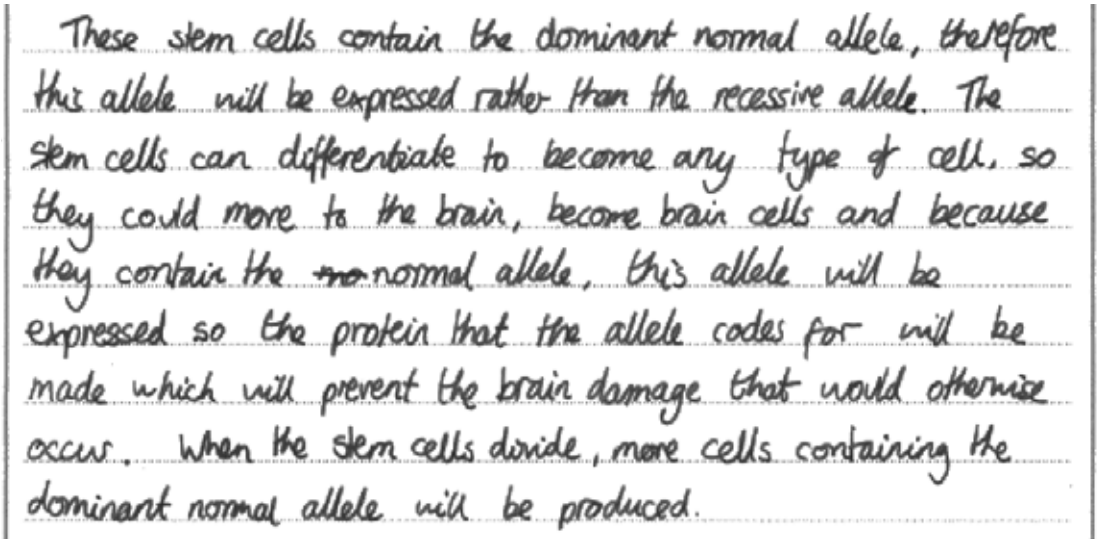
Question 3 (c) (i)

Many candidates concentrated upon detailed descriptions of the dominant gene (stated in the question stem) being carried by the virus (rather than the modified stem cell) into the child, rather than the normal/functioning gene/allele and so scored no mark here. Similarly, many described that this dominant gene would replace the recessive allele and so again gained no credit.

Transcription and translation were occasionally mentioned, along with the idea that the normal protein can now be produced by these modified cells.

A significant number of candidates gained credit by describing replication/mitosis of the stem cells, although some were confused between the virus and the stem cell and many had stem cells invading the nucleus of other cells and producing new genes.

This response gained all three available marks.


These stem cells contain the dominant normal allele, therefore this allele will be expressed rather than the recessive allele. The stem cells can differentiate to become any type of cell, so they could move to the brain, become brain cells and because they contain the ~~no~~ normal allele, this allele will be expressed so the protein that the allele codes for will be made which will prevent the brain damage that would otherwise occur. When the stem cells divide, more cells containing the dominant normal allele will be produced.

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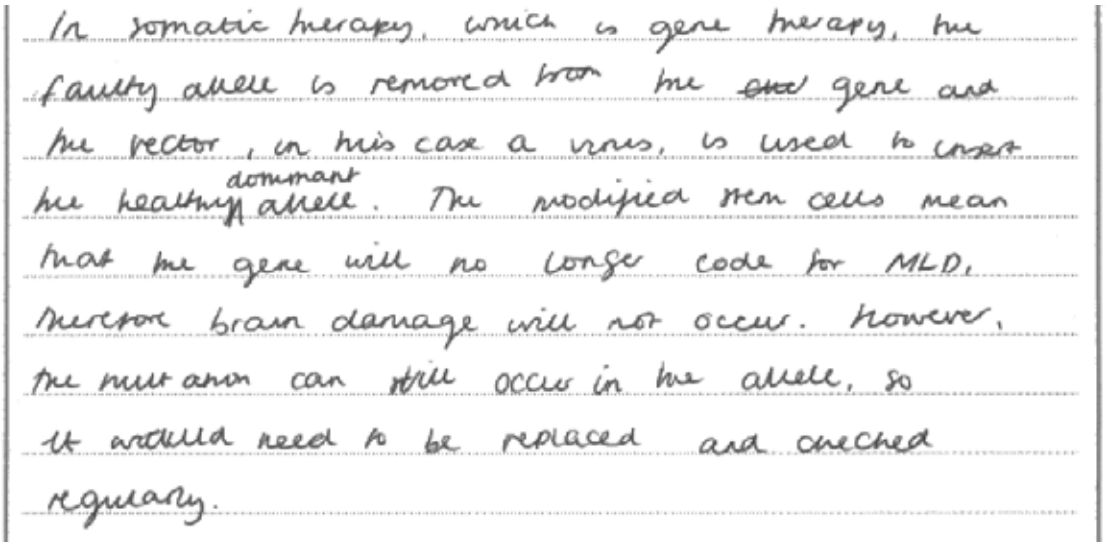
Examiner Comments

Marks were awarded for:
normal allele now in the stem cells;
protein produced from the normal allele;
stem cells can divide and make more cells.

This response gained no marks.


In somatic therapy, which is gene therapy, the faulty allele is removed from the ~~and~~ gene and the vector, in this case a virus, is used to insert the healthy dominant allele. The modified stem cells mean that the gene will no longer code for MLD, therefor brain damage will not occur. However, the mutation can still occur in the allele, so it would need to be replaced and checked regularly.

ResultsPlus
Examiner Comments

This response is typical of the many candidates who still think that somatic gene therapy removes or replaces faulty alleles, rather than adding an additional allele.

ResultsPlus
Examiner Tip

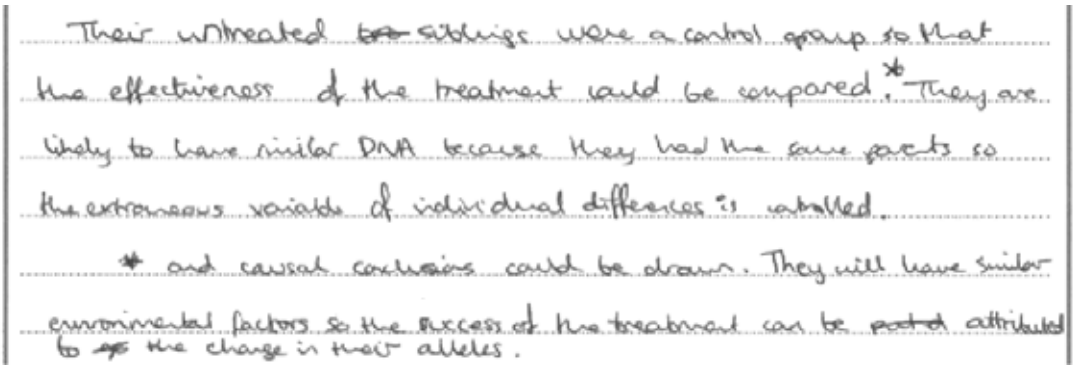
Think carefully about what is happening in somatic gene therapy, particularly when treating a recessive genetic disorder. Don't forget that the purpose is to get a normal gene into the nucleus for transcription so that the correct protein can be made to restore normal functioning of the cell if possible.

Question 3 (c) (ii)

A number of candidates gained one of the two available marks; they would establish the idea of a control group or the concept of the treatment being effective but didn't then go on to explain why they were a good control.

Similar genes were most popular with relatively few candidates identifying other factors such as the environment in which they are raised. A number of candidates lost a mark as they wrote about siblings having the same/identical genes or about DNA rather than genes/ alleles. Candidates often described how the comparison showed that the treatment was effective but failed to mention that the siblings acted as a control or that they made the comparison valid. Just stating that they would be compared was not sufficient for credit as that is what was stated in the question.

This response gained both available marks.


Their untreated ~~bro~~ siblings were a control group so that the effectiveness of the treatment could be compared.* They are likely to have similar DNA because they had the same parents so the extraneous variable of individual differences is controlled.

* and causal conclusions could be drawn. They will have similar environmental factors so the success of the treatment can be ~~noted~~ attributed to ~~as~~ the change in their alleles.

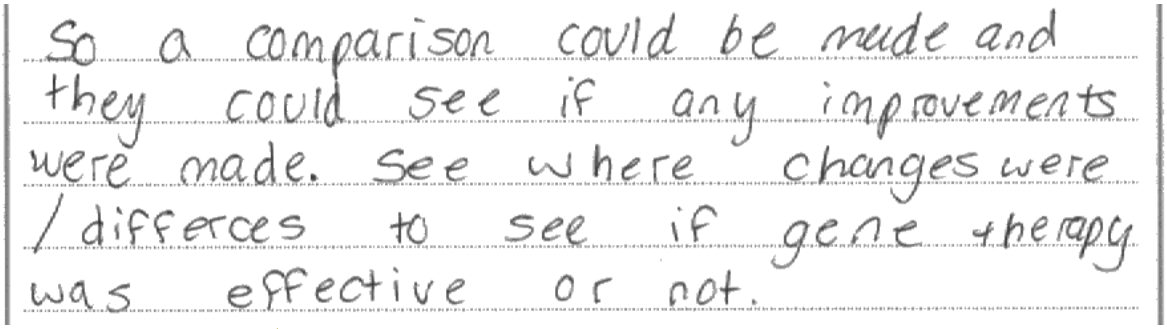
ResultsPlus
Examiner Comments

Marks were awarded for recognition that the siblings were a control group and that they are a suitable group because other variables are controlled e.g. similar environment.

ResultsPlus
Examiner Tip

Similar DNA is a bit vague as they can be said to have similar DNA to a cucumber, which would not be a suitable control for this investigation.

This response gained no marks.



ResultsPlus
Examiner Comments

This response does not go much beyond restating the question so does not gain any credit.

ResultsPlus
Examiner Tip

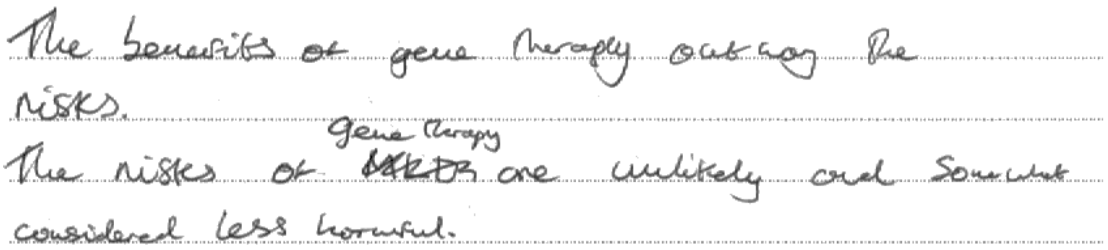
Compare is stated in the question so you need to either explain why this is a valid comparison or make it clear that you understand the concept of making use of a scientific control in an investigation.

Question 3 (d)

A large number of candidates successfully described the benefits outweighing the risks and the desire of the parents to give their child a better future. It was good to see that there were a number of candidates who described the value of scientific research and the potential future benefit to others of such trials.

Some candidates approached this question from the wrong perspective focussing on why a parent would be asked to give consent, rather than of why the consent might be given. For example, they focused upon the ethical and moral issues, such as the parents' responsibility to the child, and the legal implications if the treatment failed or went wrong. Others described that the parents would have to give consent because the baby was not able to.

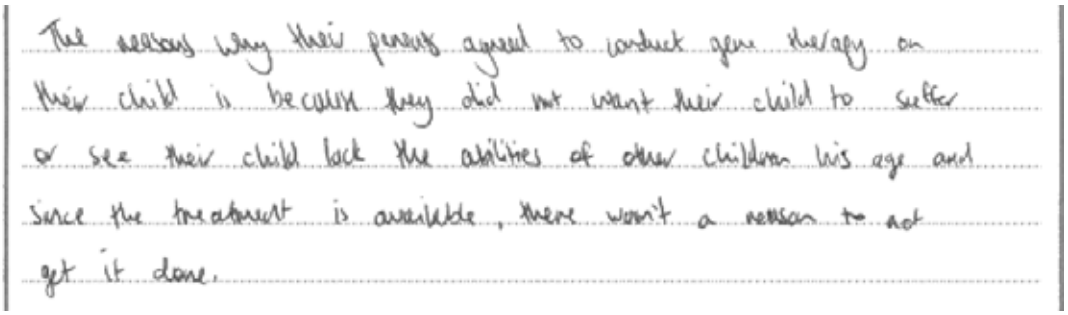
This response gained both marks.



ResultsPlus
Examiner Comments

Marks were awarded for:
benefits outweigh the risks;
the risk of gene therapy are small.

This response gained one of the two marks available.



ResultsPlus
Examiner Comments

This is an example of one of the most common correct lines of reasoning. However, only one clear point has been made so this only gets one mark.

Question 4 (a) (i)

Most candidates were able to gain both marks on this question.

However, although candidates were instructed to name substances other than protein, lipid and lactose there were a significant number of answers that still included a variation of one or more of these, e.g. amino acids or fatty acids. Other candidates referred to insoluble molecules (such as glycogen and fibre) showing a lack of understanding of the context of the question.

Some only gained one mark because they wrote minerals and then gave an example of a mineral for their second example.

Both marks awarded.

ResultsPlus
Examiner Comments

Vitamins and minerals are both worthy of credit and the example of a mineral is fine, but would not be credited as well as minerals if given as a separate substance instead of the vitamins.

This response gained one mark.

ResultsPlus
Examiner Comments

One mark was given for calcium or minerals (but not both as calcium is an example of a mineral).

'Nutrients' is a general term for most of the substances in milk so is not specific enough for credit.

This response gains no marks.

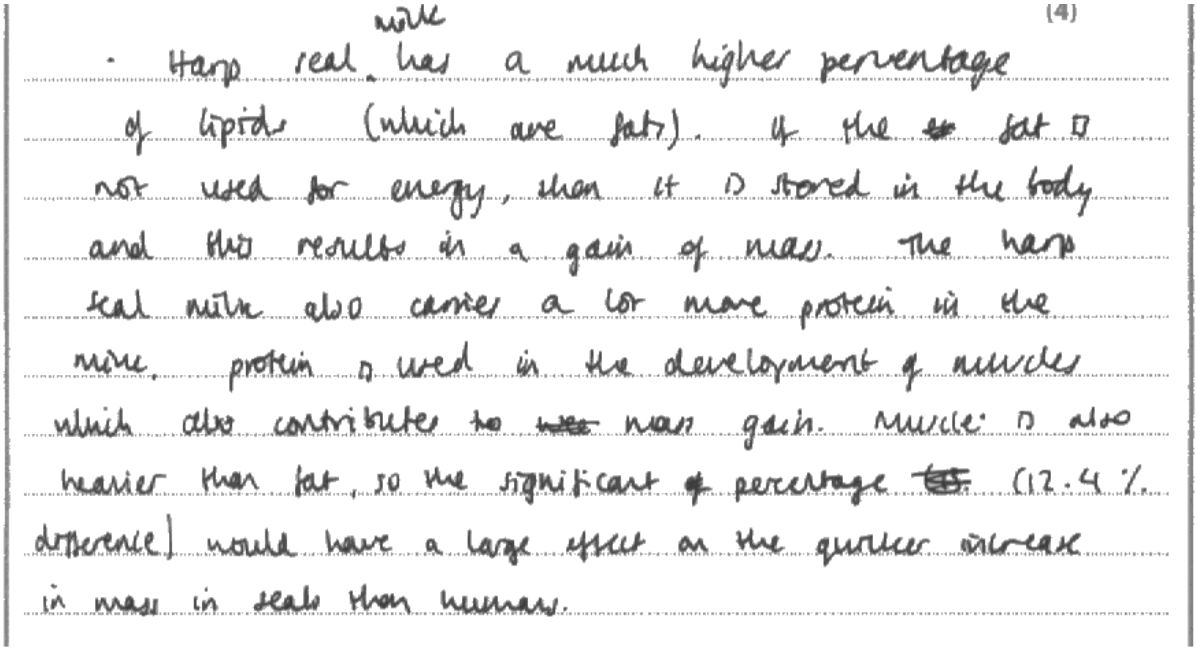
ResultsPlus
Examiner Comments

No credit was given for fat or amino acids as they are already given. When asked for two substances, three should not be listed, but starch is also not a suitable response as it is insoluble and a carbohydrate stored in plants and will therefore not be produced in milk.

Question 4 (a) (ii)

Most candidates recognised that the harp seal milk had more protein and lipid, although a small number only wrote about lipids or proteins rather than both. Many attempted a manipulation of data but too many students either calculated wrongly or just put approximations such as roughly 10 times more. Many candidates recognised that protein is needed for growth, but a common omission was that all that lipid would be stored as blubber, without clearly identifying that it is an energy source and that it is the excess energy which is stored as fat. Candidates were rarely explicit about the fact that the seals had a greater energy imbalance than humans. Some candidates placed too much emphasis on the seals needing to gain blubber for insulation in the arctic conditions, comparing this with human babies who can be clothed, be in centrally heated homes, etc. In these cases, little attention to the data was evident and often gained no marking points at all.

This response gained all four marks available.



(4)

- Harp seal milk has a much higher percentage of lipids (which are fats). If the fat is not used for energy, then it is stored in the body and this results in a gain of mass. The harp seal milk also carries a lot more protein in the milk, protein is used in the development of muscles which also contributes to mass gain. Muscle is also heavier than fat, so the significant percentage (12.4 % difference) would have a large effect on the quicker increase in mass in seals than humans.

ResultsPlus
Examiner Comments

Marks were awarded for:

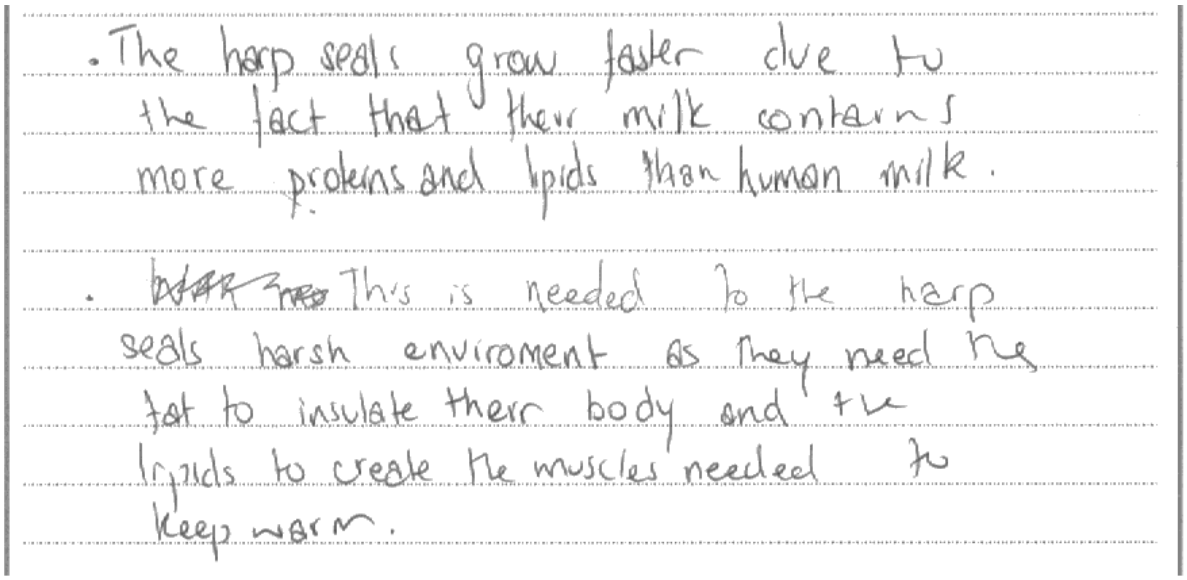
recognition that lipids are a source of energy;

more lipid and protein in harp seal milk;

protein is used in development of muscles;

there is 12.4% more protein in harp seal milk than human milk.

This response gained one of the four marks available.



ResultsPlus
Examiner Comments

A mark was awarded for recognising that the harp seal milk contained more protiens and lipids than the human milk. This was not illustrated with a suitable calculation of the differences. Why more lipid and protein results in faster mass gain has not been explained apart from the incorrect comment about lipids producing more muscles.

This is typical of the emphasis many candidates gave to the advantage of more rapid mass gain, rather than explaining how the differences in the milk result in the more rapid mass gain.

ResultsPlus
Examiner Tip

When asked to use information from a table or graph it is a good idea to include a suitable calculation to illustrate the points you are making, particularly if the question is worth more than one mark.

Question 4 (b)

(i) The majority of candidates correctly answered this, although there were some candidates who got it the wrong way round or made reference to double bonds between the carbon and hydrogen.

(ii) The vast majority of candidates made the correct calculation but there were some really odd calculations.

(iii) Most candidates appreciated that saturated fats primarily come from meat and dairy and/or plants contain unsaturated fats. Few candidates then went on to manipulate the figures to illustrate the differences. Some candidates just described how vegans eat plants and the control group eat plants and meat without linking it to fat types. A few thought that it was the milk drunk by the mothers that caused the differences.

This response gained all four marks available.

Saturated fatty acids contain no double bonds in carbon chain. Unsaturated contains one or more carbon - carbon double bonds

(ii) Complete the table below by calculating the total concentration of unsaturated fatty acids in the milk from the women in the vegan and control groups.

(1)

Group	Total concentration of saturated fatty acids / mg per g milk	Total concentration of unsaturated fatty acids / mg per g milk
Vegan	325	657
Control	497	466

(iii) Using the information given, suggest why there are differences in the concentrations of saturated and unsaturated fatty acids in the milk from the women in the vegan and control groups.

(2)

Animal meat contains higher levels of saturated fatty acids than plants which is why control have higher concentration of saturated than vegans by 172 mg per g. Plants contain lots of unsaturated fats which is why vegans have 191 mg per g more than control

ResultsPlus
Examiner Comments

Marks have been awarded for:
the difference between the fatty acids;
the correct calculations;
recognising the differences in the proportion of the fatty acids in the food sources;
correct illustration of the differences in the milk contents by use of the figures provided.

No marks were gained for any part of this response.

One has a hydrophobic head and hydrophilic tail
Other has hydrophilic head and hydrophobic tail.

(ii) Complete the table below by calculating the total concentration of unsaturated fatty acids in the milk from the women in the vegan and control groups.

(1)

Group	Total concentration of saturated fatty acids / mg per g milk	Total concentration of unsaturated fatty acids / mg per g milk
Vegan	325	557
Control	497	466

(iii) Using the information given, suggest why there are differences in the concentrations of saturated and unsaturated fatty acids in the milk from the women in the vegan and control groups.

(2)

- One will eat more meat than the other meaning a higher concentration of unsatvated fatty acids.
- The difference in the control was not much giving the sense of a balanced diet.

ResultsPlus
Examiner Comments

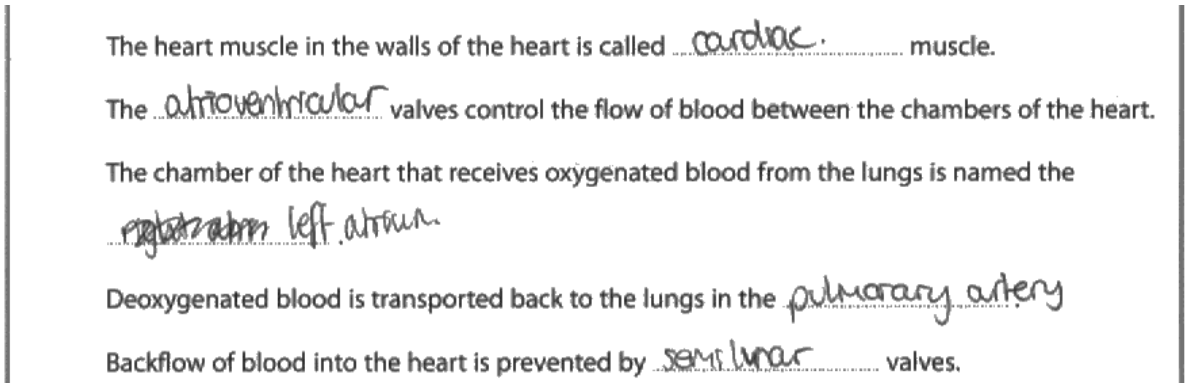
The fatty acids have been confused with phospholipids. The calculation for the vegan group is wrong by 100 (an error in writing the number down?). It is not clear from the response which group ate more meat and that meat is higher in saturated rather than unsaturated fatty acids.

Question 5 (a)

This question allowed those candidates who had learnt the structure of the heart thoroughly to gain full marks. Some candidates scored no or just 1 or 2 marks and clearly had not revised this topic. Spelling was frequently poor even of biological terms such as pulmonary.

A large number of candidates were unable to name the heart muscle or pulmonary artery. There were a lot of abbreviations for the valves AV and SL that were not accepted, and several candidates got the two sets of valves the wrong way round. Several candidates just stated atrium for the chamber accepting blood from the lungs or identified it as the right atrium.

All five marks awarded.


The heart muscle in the walls of the heart is called cardiac muscle.

The atrioventricular valves control the flow of blood between the chambers of the heart.

The chamber of the heart that receives oxygenated blood from the lungs is named the left atrium.

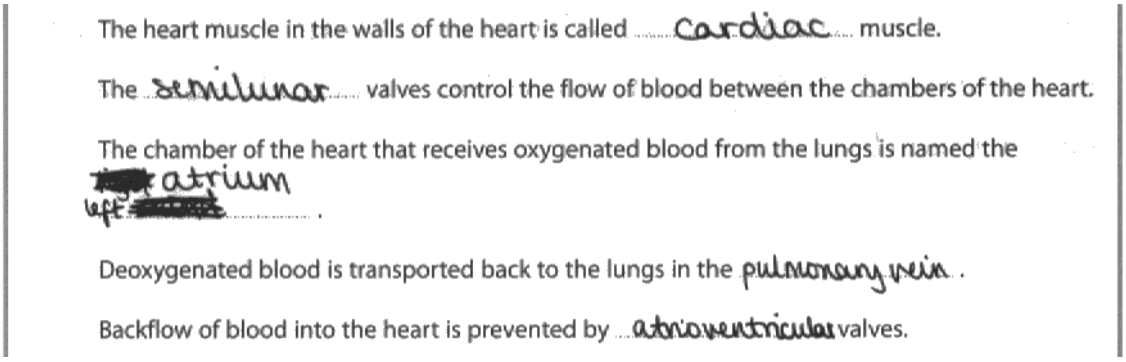
Deoxygenated blood is transported back to the lungs in the pulmonary artery

Backflow of blood into the heart is prevented by semi lunar valves.

ResultsPlus
Examiner Comments

This is an example of the many responses that chose suitable words for all five gaps.

This response gains two of the five marks available.


The heart muscle in the walls of the heart is called cardiac muscle.

The semilunar valves control the flow of blood between the chambers of the heart.

The chamber of the heart that receives oxygenated blood from the lungs is named the [redacted] atrium left [redacted].

Deoxygenated blood is transported back to the lungs in the pulmonary vein.

Backflow of blood into the heart is prevented by atrioventricular valves.

ResultsPlus
Examiner Comments

Marks were awarded for cardiac muscle and left atrium.

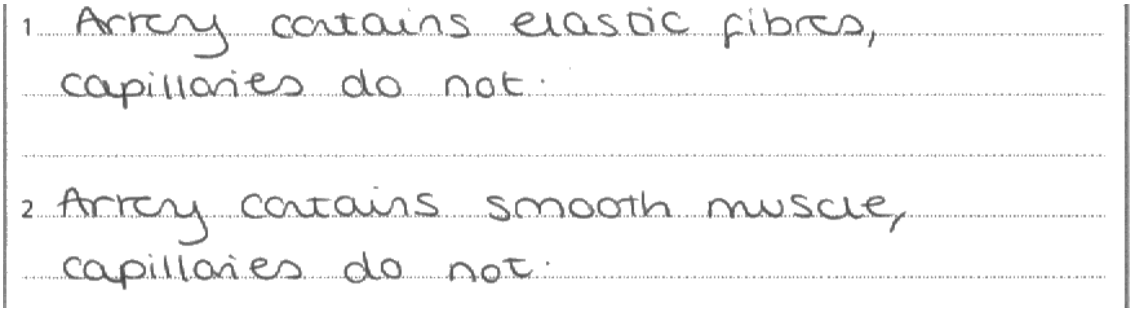
The valves are the wrong way round - a common error and arteries, not veins, carry blood away from the heart.

Question 5 (b)

Many candidates gave good clear comparative statements. However, many candidates failed to give comparisons or to clearly state that the other blood vessel did not possess those features, often just writing about the features of one of the blood vessels. The vague statement that 'capillaries are one cell thick' without being clearly comparative to a feature of arteries was very common and there were also a number of candidates who stated that 'capillaries have no lumen'.

Other common mistakes included: comparing arteries to veins; references to cell walls; stating that capillaries have muscle/elastic tissue; describing roles rather than the structures of the blood vessels.

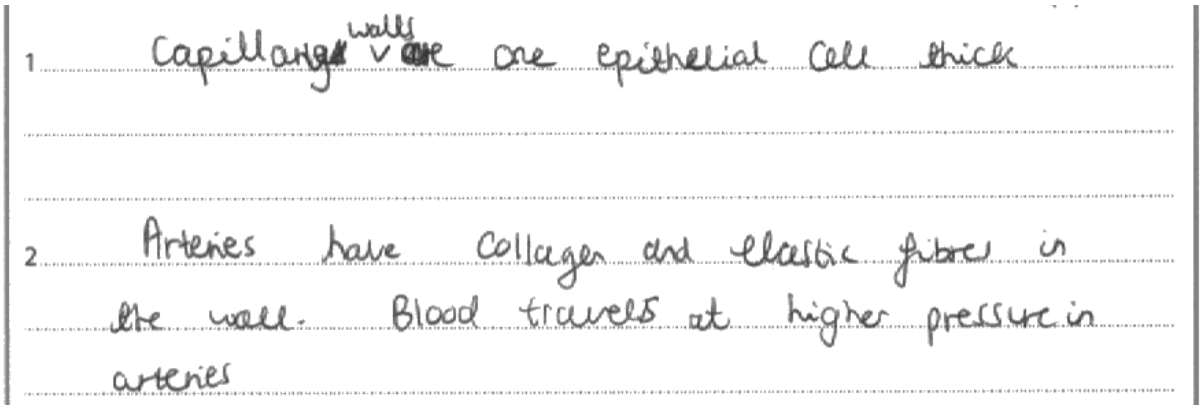
This response gained both marks.



ResultsPlus
Examiner Comments

Two clear and correct comparative statements made.

This response gained no marks.



ResultsPlus
Examiner Comments

Although the statements made are correct, they are not clearly comparative between arteries and capillaries so do not get any credit.

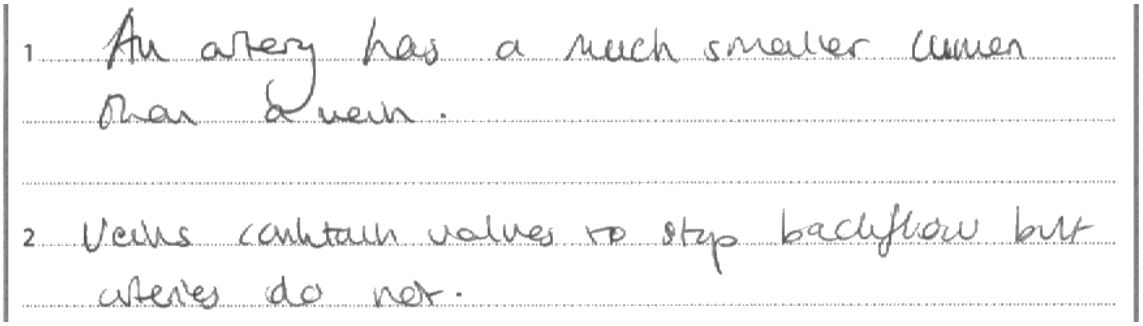
Blood travelling at a higher pressure in arteries is a comparative statement, but is not a difference in the structure so does not gain any credit.

ResultsPlus
Examiner Tip

When asked to give differences between two things make sure your answer is comparative and mentions both things being compared.

Make sure you are clear of the difference between structure and function.

This response gained no marks.



ResultsPlus
Examiner Comments

This is an example of the candidates who made the wrong comparison and therefore gained no credit.

ResultsPlus
Examiner Tip

Read the question carefully and make sure you are clearly comparing the two things outlined in the question.

Question 5 (c) (i)

Most candidates focused upon the reduction in blood clotting, but did not explain how, and often then went on to successfully make reference to lack of blood clots preventing vessels from getting blocked. Some candidates identified the reduction in sticky platelets, but only a few made reference to clotting factors.

A significant number of candidates wrongly described how they reduced blood pressure and/or reduced blood cholesterol, confusing anticoagulants with antihypertensives or statins. Some referred to blood being thinned – not credit worthy at AS level.

This response gained both available marks.

Anticoagulants help prevent blood clots by stopping platelets from becoming so sticky which ~~stops~~ reduces the size of blood clots in damaged artery arteries so keeps the arteries more open. This helps prevent atherosclerosis occuring so reduces the risk of CVD.

ResultsPlus
Examiner Comments

Marks were awarded for preventing blood clots and reducing the stickiness of platelets.

This response gained no marks.

(i) Explain how anticoagulants can help reduce the effects of CVD. (2)

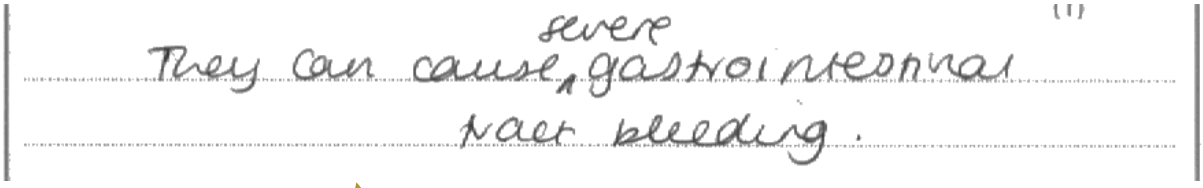
They reduce high blood pressure which reduces the chance of CVD as it lowers the risk of diseases such as atherosclerosis and a stroke.

ResultsPlus
Examiner Comments

This is a typical example of the responses that confused anticoagulants and antihypertensives.

Question 5 (c) (ii)

Most candidates gained the mark through discussion of uncontrolled blood loss. Some candidates confused anticoagulants with antihypertensives or statins and gave side effects linked to those drugs such as dizziness and liver damage.



ResultsPlus
Examiner Comments

This response gained the available mark.

This response gained no marks.

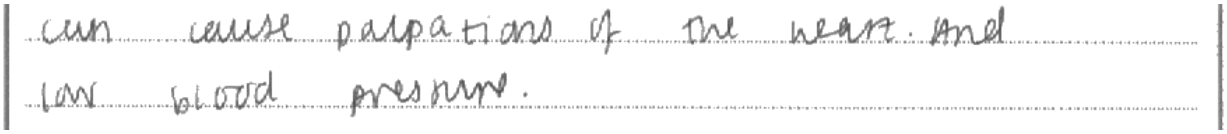
ResultsPlus
Examiner Comments

This is typical of the candidates who listed possible risks of statins rather than anticoagulants.

ResultsPlus
Examiner Tip

Check you know the benefits and risks of the different treatments for the causes of CVD to avoid making mistakes.

This response gained no marks.



ResultsPlus
Examiner Comments

This is typical of those who confused the effects of antihypertensives and anticoagulants.

Question 6 (b)

Very few candidates scored 2 marks for this question. A significant proportion of the candidates did not know the difference between reliability and validity. That meant that many responses were based around improving reliability, despite the question just before being about reliability.

The majority of candidates restated information in the question and described the control of age and gender. Those candidates who scored 1 or 2 marks gained them for controlling exercise/activity levels and/or smoking etc. Those who did try to write about controlling the breakfast portions used vague terms like amount and very few mass etc.

A significant number of candidates thought that 'no breakfast' was a control for this investigation.

This response gained both marks available.

Made sure the samples only ate one type of breakfast during the investigation. All excercised the same amount or did not excercise. All ate relatively the same amount of breakfast. All ar breakfast relatively at the same time.

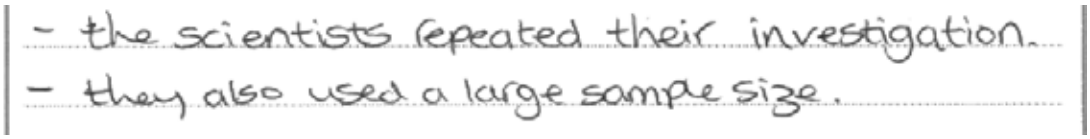
ResultsPlus
Examiner Comments

Marks were awarded for eating the same type of breakfast during the investigation and controlling the exercise levels.

ResultsPlus
Examiner Tip

Avoid using vague terms like 'amount' that are not possible to measure. In this response eating the same amount of breakfast would not have been given credit. The same mass of breakfast would have been better as that can be measured.

This response gained no marks.



ResultsPlus
Examiner Comments

This response is typical of those who mixed up reliability and validity.

ResultsPlus
Examiner Tip

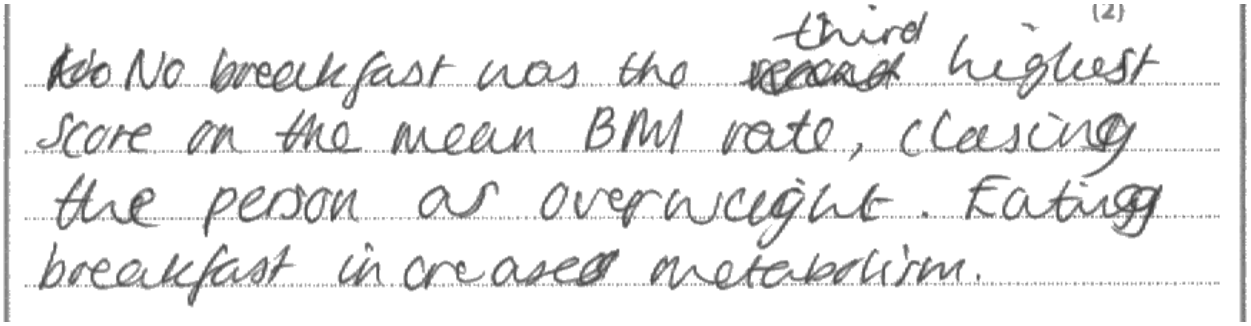
Read through the whole question to help guide your response. We are not likely to ask two questions about the reliability of the same investigation next to each other.

Question 6 (c)

Many candidates focused upon the BMI being in the overweight category as their full answer and therefore scored no marks as this was true for all breakfast types as well. However, many did compare the BMIs and often successfully identified the no breakfast as the 3rd highest, but only some gave a correct calculated difference to illustrate this (several misread the scale of the graph).

Few candidates discussed the idea that it could affect the metabolic rate and only some clearly discussed the total energy balance during the day. However, a significant number of candidates gained credit for the idea that they may eat more during the rest of the day e.g. through snacking or larger lunches.

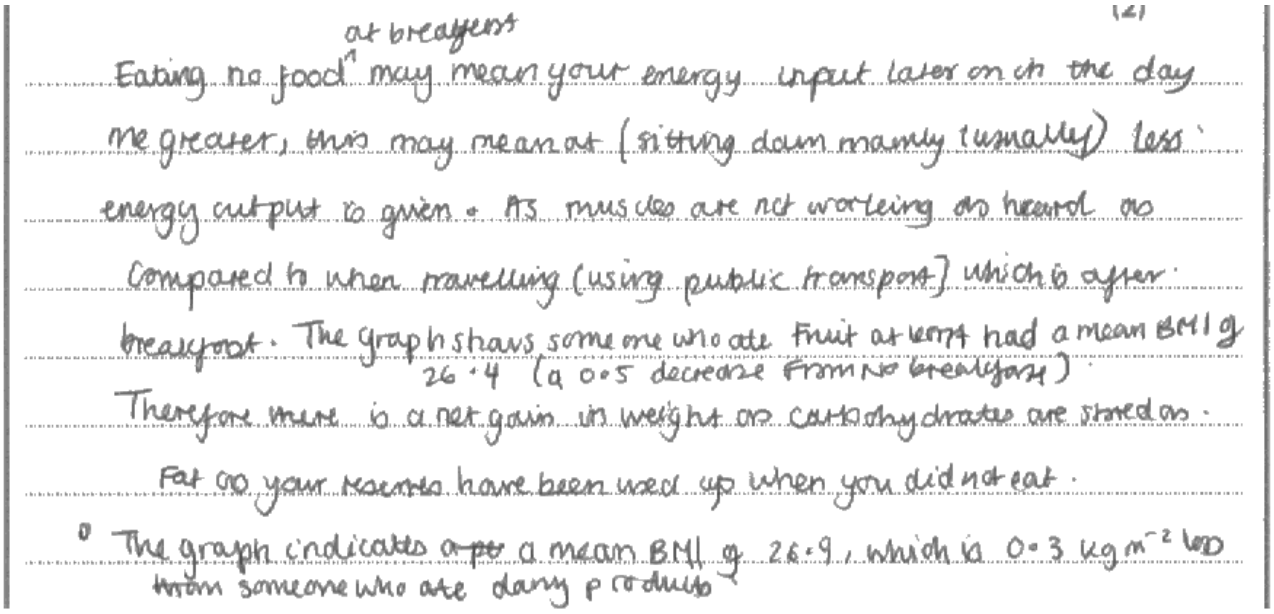
This response gained both available marks.



ResultsPlus
Examiner Comments

Credit was given for recognising no breakfast has the third highest BMI and the suggestion that eating breakfast may increase metabolism.

This response gained both available marks.



ResultsPlus
Examiner Comments

Credit was given for:
energy input may be greater (or output lower) later in the day;
correct comparison of BMI to an alternative breakfast;
correct numerical comparison between the breakfasts using the data in the graph.

Question 6 (d)

Those candidates who gained some marks mostly included the identification of cooked cereal having the lowest BMI and clearly identifying the link between cholesterol and atherosclerosis. Very few candidates discussed the link between BMI and blood pressure and in fact many considered cholesterol the cause of high blood pressure.

The role of fibre, cholesterol, HDLs and LDLs was confused by many candidates. The most common misconception appeared to be either that the fibre travelled around the blood stream clearing cholesterol, or that the fibre contained HDL cholesterol that then entered bloodstream. Few candidates wrote about dietary fibre not being digested.

It appeared that many candidates ignored the data and the context of the question and just wrote about their knowledge of blood cholesterol.

This response gained all three marks.

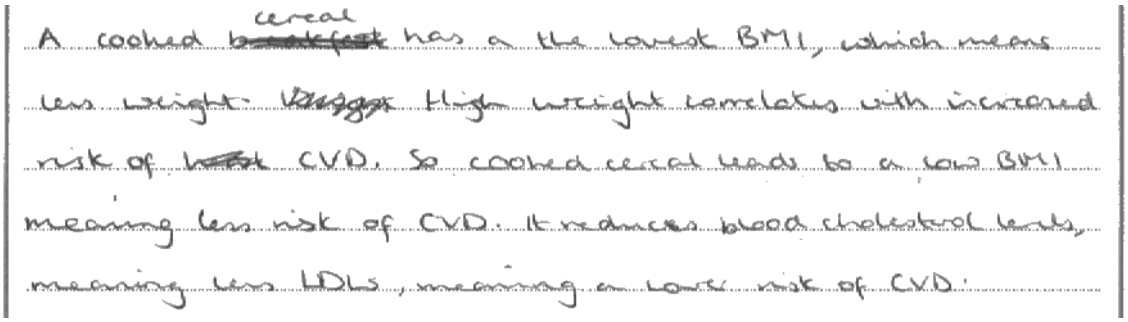
A breakfast of cooked cereal is the group with the lowest BMI on average. Dietary fibre prevents the uptake of cholesterol in the digestive system which would result in lower blood cholesterol. Lower blood cholesterol results in a reduced risk of fatty deposits building up around sites of damage in arteries and therefore reduces risk of ~~atheromas~~ atheromas that may lead to narrowing of arteries lumens leading to an increase in blood pressure. Or blockage of artery lumens leading to heart attacks or stroke

(Total for Question 6 = 11 marks)

ResultsPlus
Examiner Comments

Marks were awarded for:
lowest BMI;
fibre prevents the uptake of cholesterol on the digestive system;
lower blood cholesterol reduces the risk of atherosclerosis.

This response gained one of the three available marks.

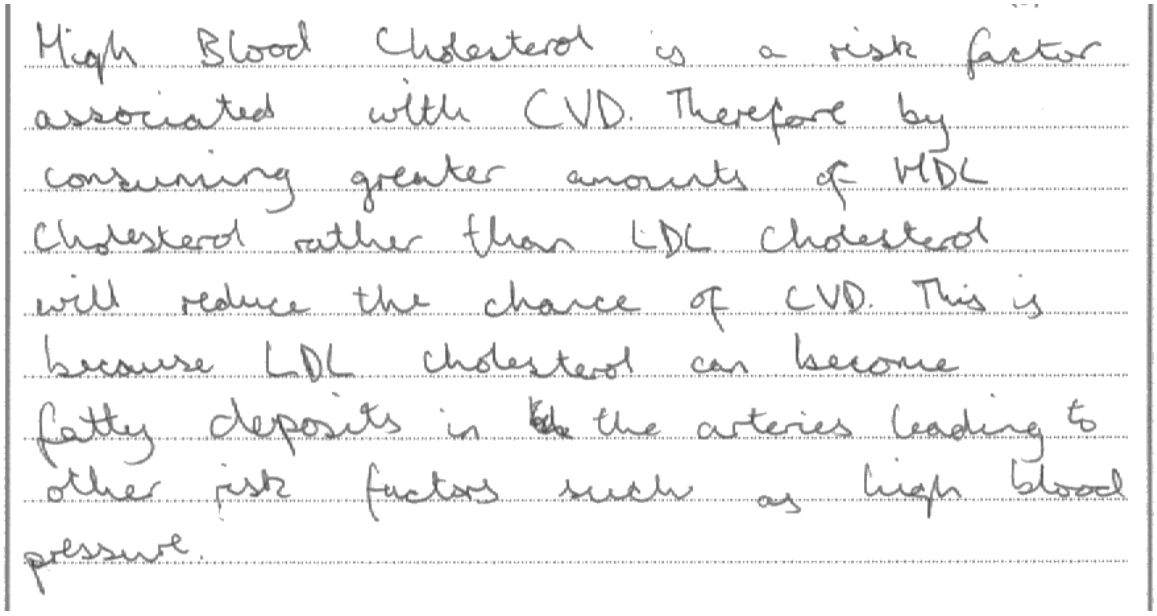


ResultsPlus
Examiner Comments

Credit was given for recognising that the group eating cooked cereals had the lowest BMI of all groups. However, the reasons for lower risk of CVD are not clearly linked to the specifics of the diet. Why lower blood cholesterol lowers the risk of CVD is also not explained.

Restating information given in the question (lower blood cholesterol and less risk of CVD) is not going to gain credit - candidates need to explain the link.

This response gained no marks.



ResultsPlus
Examiner Comments

This response is typical of those who principally wrote about HDL and LDL without linking it to the information provided about the diet or the lower BMI.

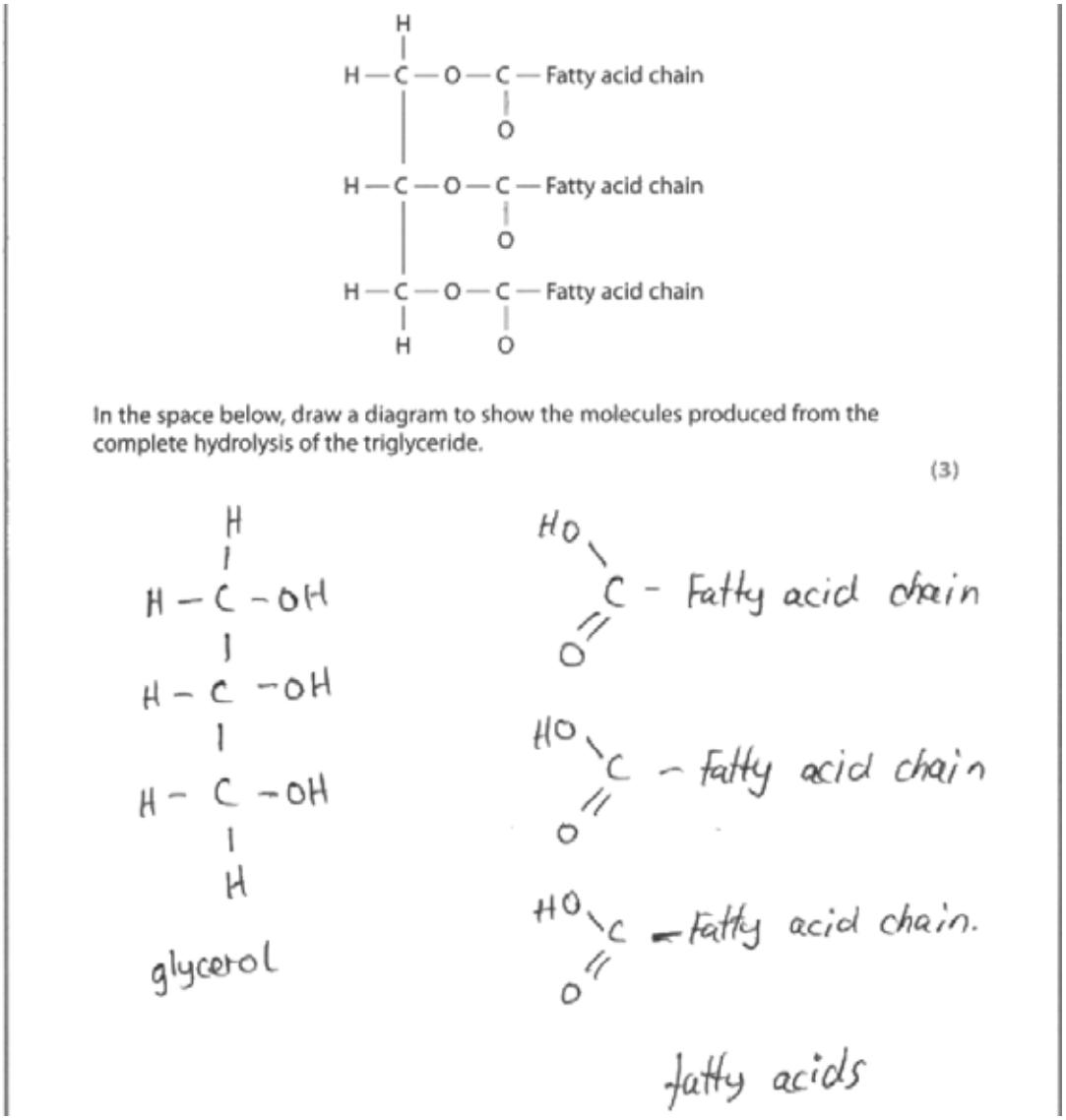
Question 7 (a)

A significant number of candidates drew the products accurately and gained all three marks. A significant number also scored no marks, by either leaving the answer blank, copying the full triglyceride, drawing some random products or even including completely different molecules such as attempts at glucose or amino acids as a product.

Common errors that prevented all three marks being awarded included:

a lack of the 3 OHs on glycerol the incomplete or total lack of COOH at the end of the fatty acids.

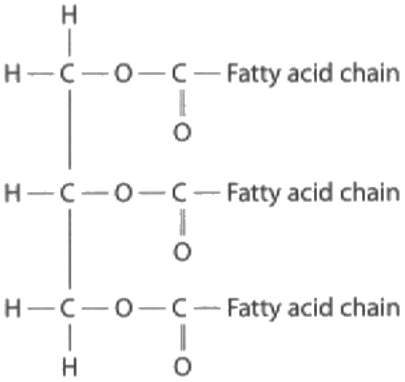
This response gained all three available marks.



ResultsPlus
Examiner Comments

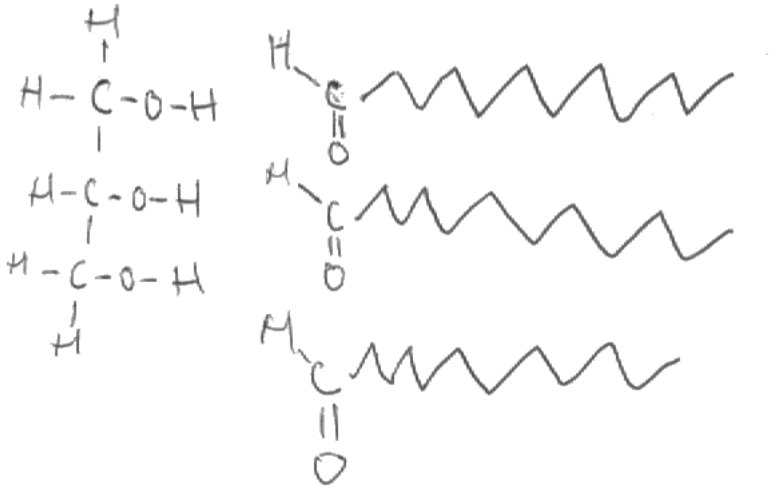
All products have been correctly drawn for maximum credit.

This response gained two of the three marks.



In the space below, draw a diagram to show the molecules produced from the complete hydrolysis of the triglyceride.

(3)



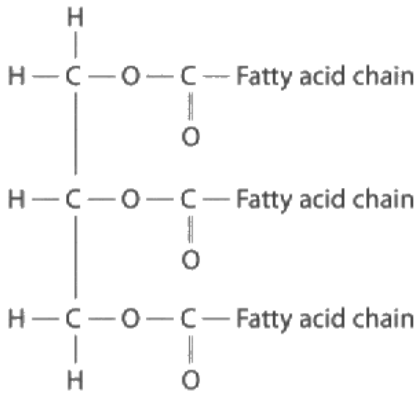
ResultsPlus
Examiner Comments

The products have been identified and drawn, but one mark has been lost as each fatty acid has been drawn with an H rather than OH group.

ResultsPlus
Examiner Tip

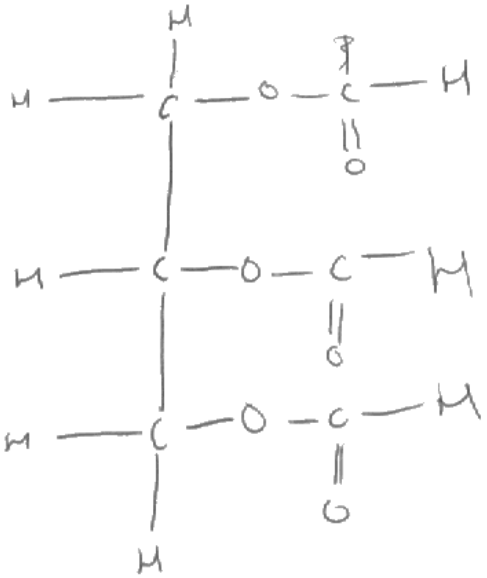
Remember that hydrolysis involves H_2O, double check your molecules drawn to make sure you have not lost any atoms. In this case H_2 has been added to each bond split by hydrolysis instead of H_2O.

This response gained no marks.



In the space below, draw a diagram to show the molecules produced from the complete hydrolysis of the triglyceride.

(3)



ResultsPlus
Examiner Comments

Just changing the fatty acid chain into a hydrogen is not an accurate hydrolysis reaction and only one product is shown which is not a correct glycerol molecule.

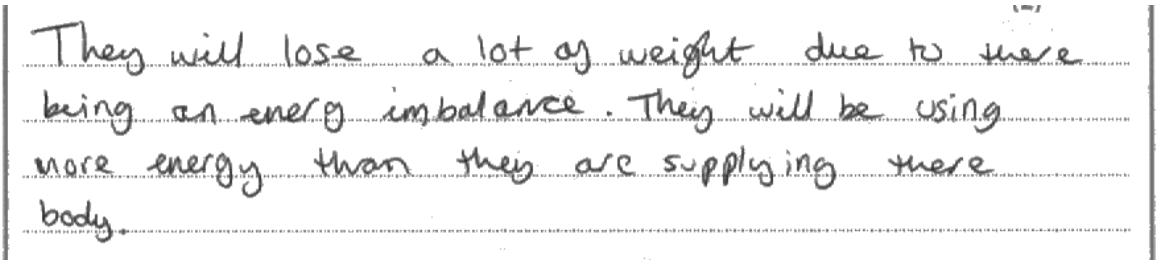
If you are asked to show the molecule**s** produced make sure you include more than just one product as things don't disappear.

Question 7 (b)

Many candidates were able to link the diet and lifestyle to the idea that the person would lose weight but many were unable to go on and explain why for a further mark, mainly because they did not mention it in terms of an energy imbalance. Some candidates referred to fatigue and muscle wastage, but rarely mentioned the necessity for eating more carbohydrate/protein for energy balance. A few candidates looked for extreme consequences and thought that the person was likely to die as a direct result.

Some candidates referred to saturated and unsaturated fats or HDLs and LDLs, producing answers that made no sense at all in relation to the question asked.

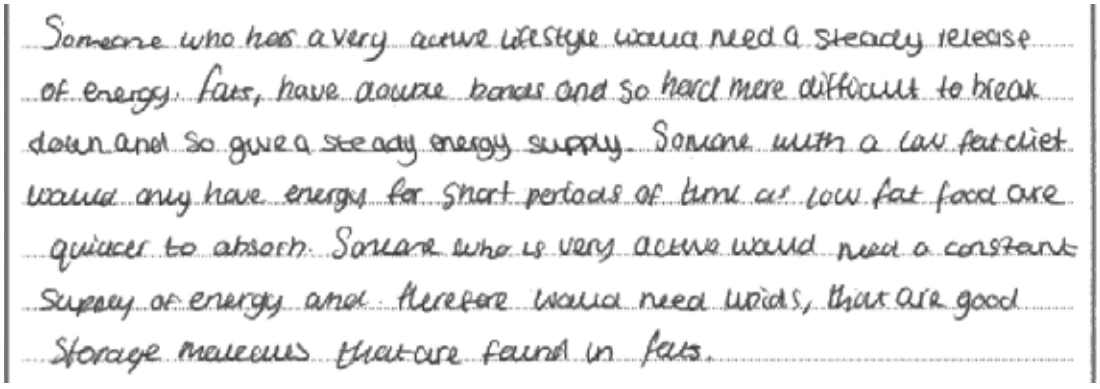
This response gained both available marks.



ResultsPlus
Examiner Comments

This is an example of a concise response that clearly identifies a consequence (loss of weight) with the energy imbalance resulting from the situation described.

This response gained no credit.



ResultsPlus
Examiner Comments

This response is typical of some that described what is needed from the diet rather than the consequences of the energy imbalance.

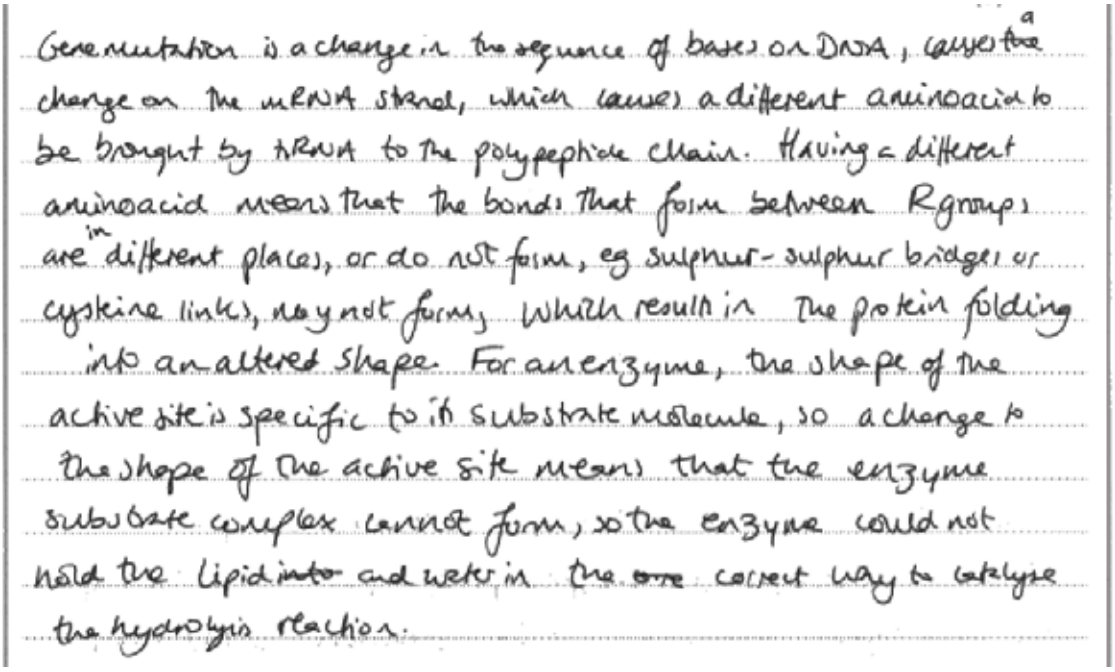
Question 7 (c)

There was a perfect spread of marks for this question with equal numbers of candidates gaining 0, 1, 2, 3, 4, or 5 marks; with most candidates demonstrating an understanding of the relationship between genetic change and an alteration to the enzyme. Candidates who gained the higher marks in the question told a clear and detailed story of how a gene mutation leads to the non-functioning of an enzyme.

Many responses lacked detail for describing a mutation in terms of a change to the DNA sequence or a change in the base sequence of a gene. There were vague references to changes in base sequence but this was rarely qualified by the gene, and often was described with reference to the amino acid base sequence. Most were able to recognise that a mutation would lead to a change in amino acids but few linked this to a change in R groups. Candidates were able to recognise that folding changed but some vaguely mentioned that this would change the active site but did not describe what this change would be (shape or properties).

Some candidates described the normal process of protein synthesis without specifying how this would be different due to mutation, e.g. that the bonds would be in different positions, that the 3D structure would be different, therefore they were not addressing the question.

This response gained all five marks available.



Gene mutation is a change in the sequence of bases on DNA, causes a change on the mRNA strand, which causes a different amino acid to be brought by tRNA to the polypeptide chain. Having a different amino acid means that the bonds that form between R groups are in different places, or do not form, eg sulphur-sulphur bridges or cystein links, may not form, which result in the protein folding into an altered shape. For an enzyme, the shape of the active site is specific to it's substrate molecule, so a change to the shape of the active site means that the enzyme substrate complex cannot form, so the enzyme could not hold the lipid into and water in the correct way to catalyse the hydrolysis reaction.

ResultsPlus

Examiner Comments

This is a typical example of the many clear and concise responses seen.

Credit was given for:

description of what a gene mutation is;

change in the amino acids;

different bonds between the R groups;

change to the folding of the protein;

the shape of the active site is changed;

enzyme-substrate complex can't form.

This response gained three of the five marks available.

A gene mutation will change the base sequence of amino acids (primary structure), therefore altering the 3D structure of the enzyme. If a different sequence is produced, the folding of the polypeptide chain will be altered and the bonds formed between the R groups will be changed. The bonds and interactions between the R group maintain the 3D shape. The lipid will not fit into the enzymes active site as the active site has a specific shape for each substrate. There will be no enzyme-substrate complexes so lipids cannot be broken down.

ResultsPlus
Examiner Comments

Marks were given for:

change in the 3D structure of the enzyme;

change in the bonds between R groups;

idea that the lipid does not fit the enzyme's active site.

As this is a question that assesses the quality for written communication, points must be made clearly. For example in this case changing the base sequence of amino acids has confused DNA and the primary structure of the protein so this was not given credit.

This response gained no marks.

The mutation causes a change in the gene that codes for an enzyme. This will prevent the enzyme from doing it's job (breaking down lipids) resulting in a build up of these lipids. The mutation may have caused the gene that codes for the enzyme to change resulting in the creation of a different enzyme. This means the enzyme will be unable to break down lipids but may instead have the opposite function causing them to build up

ResultsPlus
Examiner Comments

Although this candidate has got the general idea of what is happening they have not gone much beyond restating the information in the question and have therefore not included the biological detail and clarity needed to explain why the gene mutation results in an enzyme that can't break down lipids.

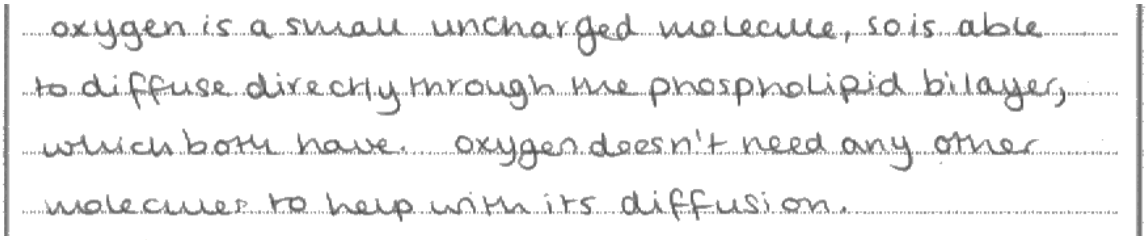
The nature of the gene mutation is not explained, neither is the change to the enzyme.

Question 8 (a)

Those candidates that realised oxygen is a small molecule usually went on to correctly refer to diffusion. Other responses, however, were along the lines of all cells need oxygen for respiration and stating that as a reason for high permeability.

Some candidates lost marks by contradicting themselves as regards diffusion/facilitated diffusion, small but charged/polar etc.

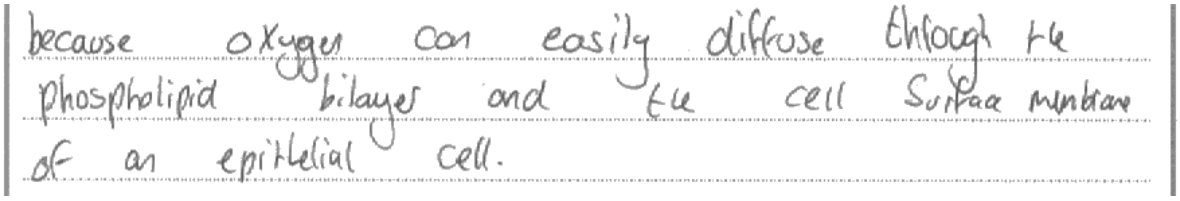
This response gained both marks available.



ResultsPlus
Examiner Comments

This gained credit for recognising that oxygen can diffuse across the bilayer and that it can do this because it is small and uncharged.

This response gains one of the two available marks.



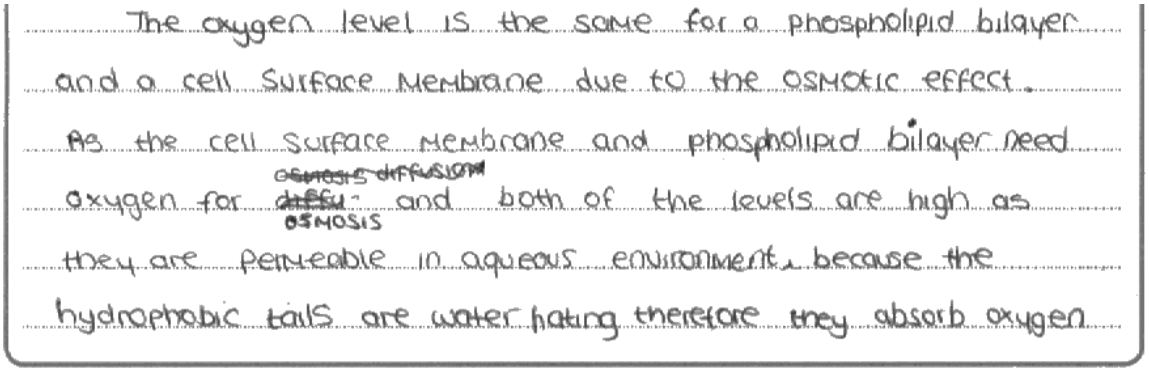
ResultsPlus
Examiner Comments

This response makes one clear point about the ability of oxygen to diffuse through the membranes.

ResultsPlus
Examiner Tip

If a question is worth two marks and has asked for an explanation, make sure your answer is not just a partial answer by checking you have at least two clear statements and in this case explain why oxygen is able to diffuse.

This response gained no credit.



ResultsPlus
Examiner Comments

This response is typical of those which relate permeability to need rather than the structure of the membranes. It has also confused osmosis and diffusion.

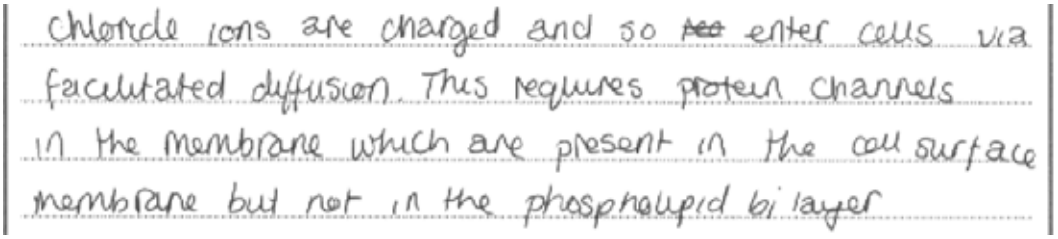
Question 8 (b)

This question was attempted well with the majority of candidates being able to discuss the idea that carrier proteins were needed to move chloride ions across a membrane and some linked this to facilitated transport or active transport. Some candidates accurately described the CFTR channel proteins and their involvement because of the context of the question.

A lot of answers mentioned chloride ions being charged, but also, quite a few said that they are big/polar.

Some candidates unfortunately believed that the question was referring to the process by which mucous viscosity is controlled and discussed electrical gradients and the 'need to transport chloride' rather than explaining the difference in permeability.

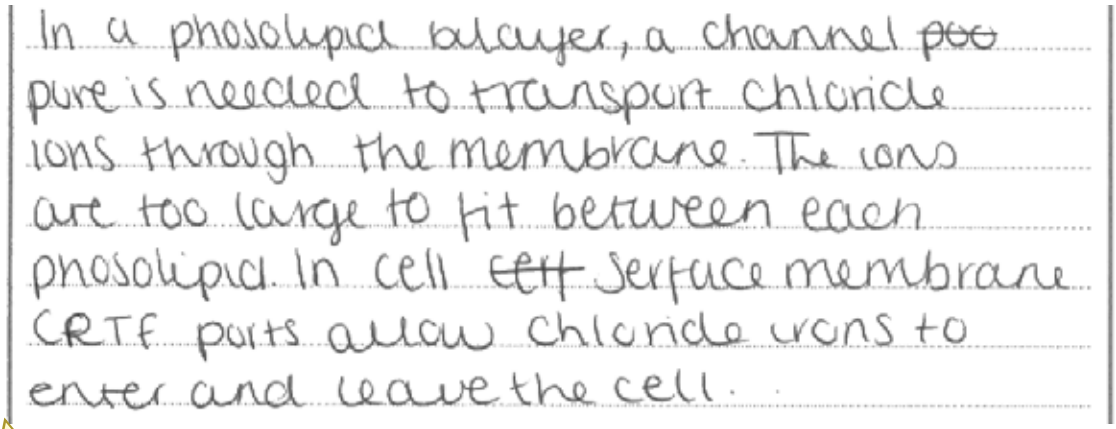
This response gains all three marks available.


Chloride ions are charged and so ~~they~~ enter cells via facilitated diffusion. This requires protein channels in the membrane which are present in the cell surface membrane but not in the phospholipid bilayer

ResultsPlus
Examiner Comments

Marks were awarded for:
chloride ions are charged
facilitated diffusion
protein channels in the cell surface membrane and not the phospholipid bilayer.

This response gained 0 marks.


In a phosolipid bilayer, a channel ~~poo~~ pore is needed to transport chloride ions through the membrane. The ions are too large to fit between each phosolipid. In cell ~~cell~~ serface membrane CRTF ports allow chloride ions to enter and leave the cell.

ResultsPlus
Examiner Comments

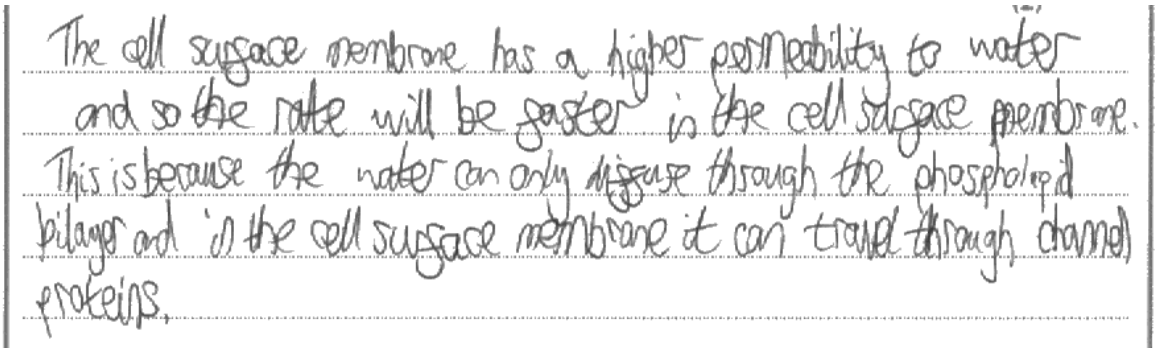
Channel pore is not sufficient for channel protein and CRTF ports (rather than CFTR) does not get credit unless stated that it is a channel protein. It is the charge rather than the size of the chloride ions that prevents them diffusing across a phospholipid bilayer.

AS level Biology does require some precision and clarity over the way knowledge is expressed to gain credit.

Question 8 (c)

Relatively few candidates scored well on this question. Many responses focussed on the formation of concentration gradients due to the movement of chloride ions across the respective membranes. Rarely did they concentrate on the actual ability for water to move through (e.g. by means of channel proteins) and incomplete references to the cell membrane being more permeable to water. A significant number of candidates believed that the reason for the different rates is that one membrane was thicker than the other. Others explained that the phospholipid bilayer is impermeable to water, or that osmosis is the movement of the chloride ions.

This response gained both marks available.



ResultsPlus
Examiner Comments

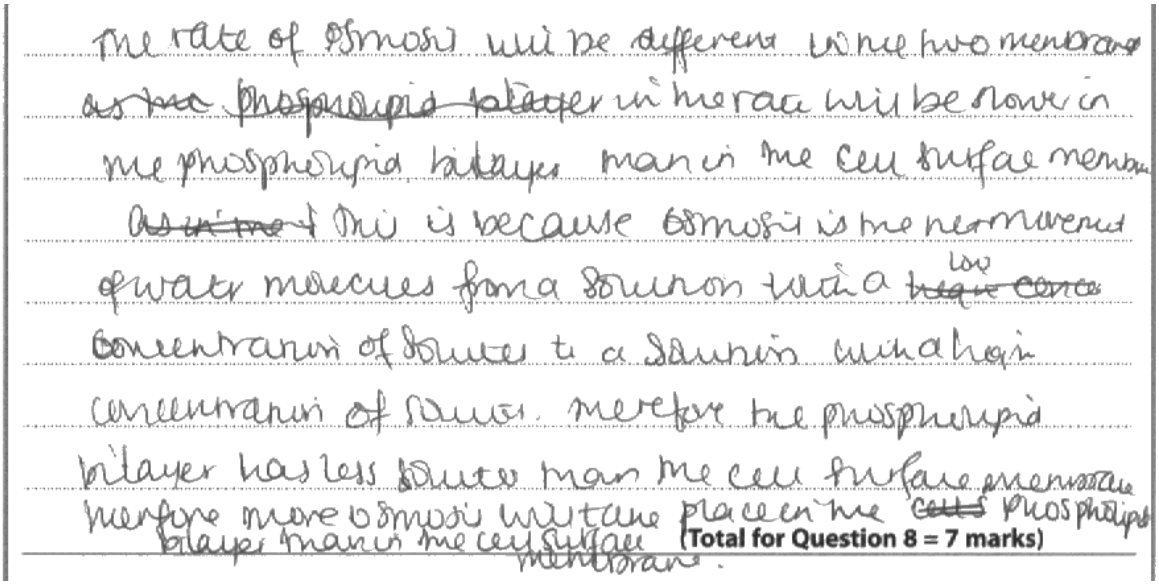
Marks were gained for:

cell surface membrane has higher permeability to water;

water can diffuse through phospholipid bilayer;

can travel through channel proteins in the cell surface membrane.

This response scored 0 marks.



ResultsPlus
Examiner Comments

This response is typical of the many responses that ignored the differences in permeability to water between the membranes and focused on a concentration gradient.

ResultsPlus
Examiner Tip

Look carefully at the labelling and information on the graphs/diagrams provided.

Paper Summary

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

- read the whole question carefully, including the introduction, to help relate your answer to the context asked. You should read the question through carefully at least once and then write down your knowledge and understanding in a way that answers the question without repeating information already given in the question stem;
- don't assume that the question asked is the same as that which has appeared on a previous paper;
- read your answers back carefully – do they answer the question, have you made at least as many clear points as marks are available, and have you made any silly mistakes (e.g. does your answer make sense);
- when asked to distinguish between two things make sure your answer is comparative and mentions both things being compared;
- include a calculation whenever you are asked to describe or compare numerical data (particularly data presented in graphs);
- when describing the measurement or control of variables, be specific about what is to be measured e.g. volume or mass, and avoid vague terms such as amount;
- pay particular attention to spelling, the use of technical names and terms, and organisation of your answer in QWC labelled extended writing questions;
- explore and assess examples of candidate responses from this report to help you understand what makes a good response to different types of question, and exemplify the level of knowledge and understanding expected at AS level.

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

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