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June 2018

GCE Biology 8BN0 01

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Introduction

The paper was the third cycle 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 questions on this paper yielded a wide range of responses and some very good answers were seen; resulting in a good spread of marks. The paper appears to have worked very well with all questions achieving the full spread of marks. Very few questions were left blank and there was no evidence in the vast majority of entries that candidates had insufficient time to complete the paper. For example, nearly all candidates wrote lengthy answers to the last question on the paper.

There were some straightforward questions that yielded high marks across the ability range and some more challenging questions that discriminated well. It was very pleasing to see such large numbers of excellent responses which were clear and comprehensive, showing a good use of appropriate biological terminology. The responses to Question 7(a)(ii) in particular, were very well structured, used the correct terminology and were therefore high scoring.

It was clear that some candidates still do not read the command words carefully enough and ignored information provided in the question. Therefore they dropped straightforward marks by not answering appropriately – for example, describing instead of making comparative statements in 'compare and contrast' questions. Many candidates did not refer to data provided in the question, for example in 5biii, 6b, 7ai and 8d, limiting the number of marks that they could access. In 3(b), many candidates did not relate the core practical to the concentrations given in the graph and therefore could not access the fifth marking point.

Questions that demanded recall, or that tested areas of the specification tested in previous years, tended to score very well. Calculations were usually correct, demonstrating an improvement from previous years.

However, when asked to analyse and explain data and apply their knowledge to unfamiliar contexts, many candidates found the marks harder to obtain. The application of knowledge regarding protein synthesis and exocytosis, incomplete dominance and effect of mutations proved more challenging for some students.

Question 1 (a) (ii)

This question asked candidates to state how an unsaturated lipid differs from molecule C.

This required candidates to recognise that molecule C in the diagram above was a saturated (phospho) lipid. It was clear from students responses that they recognised that molecule C was saturated.

The majority of candidates correctly identified that an unsaturated lipid would contain double bonds between the carbon atoms in a fatty acid chain. However, some were a little vague in their answers and just wrote that there would be double bonds. This was not a sufficient answer as molecule C also contains double bonds (P=O, C=O).

Some students tried to explain how an unsaturated triglyceride would differ in structure to a saturated phospholipid. Answers included ideas such as an extra fatty acid chain would replace the phosphate group. However, this did not answer the question asked.

A significant minority of candidates focused on the C=O in the diagram of molecule C and stated that an unsaturated lipid would not have this bond.

(ii) State how an unsaturated lipid differs from molecule **C**.

(1)

Unsaturated lipids contain fatty acid chains with carbon-carbon double bonds, the lipid C doesn't.

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Examiner Comments

This response correctly identified that there would be C=C bonds and scored 1 mark.

(ii) State how an unsaturated lipid differs from molecule **C**.

(1)

An unsaturated lipid has no double bonds and it's a straight chain of carbon without any oxygen.

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Examiner Comments

This response has incorrectly stated that an unsaturated lipid contains no double bonds and scored 0 marks

ResultsPlus
Examiner Tip

Be specific about what the bonds are

(ii) State how an unsaturated lipid differs from molecule **C**.

(1)

Unsaturated lipid has a ~~fatty~~ double bond in the hydrocarbon tail.

ResultsPlus
Examiner Comments

This response did not clarify that the double bond was between carbons and therefore could not be awarded the mark.

Question 1 (b)

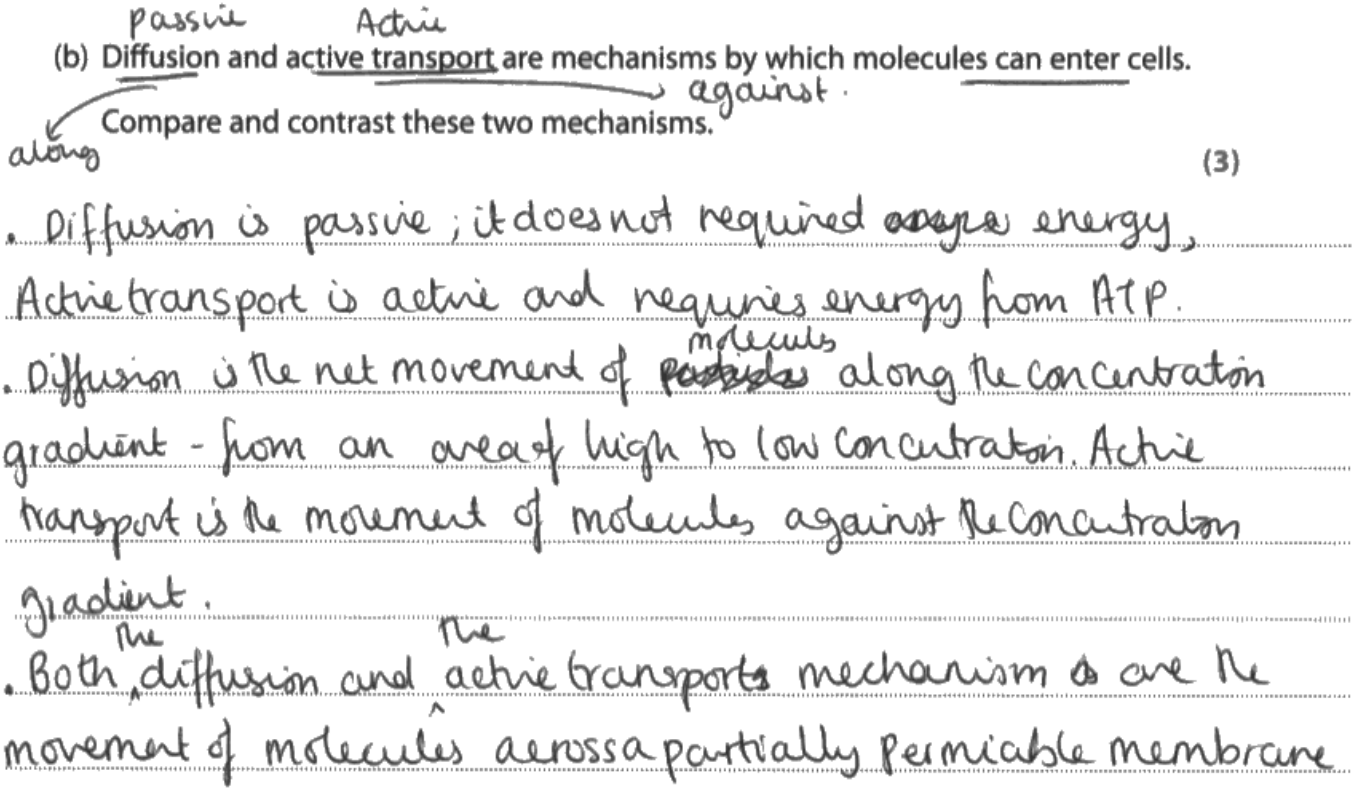
This question asked candidates to compare and contrast diffusion and active transport. These command words required candidates to identify both similarities and differences between these two mechanisms.

It was clear that there has been some improvement in this style of question, with some excellent comparative answers seen. However, some candidates still wrote statements about one mechanism and did not contrast it with the other mechanism.

It was clear that candidates understood the differences between the two and a large majority of candidates gained two marks for the third and fourth marking points.

However, it was clear that many students did not realise that they should also give at least one similarity and therefore they were not able to access the third mark.

A small minority of students recognised that both facilitated diffusion and active transport moved molecules through proteins.



(b) Diffusion and active transport are mechanisms by which molecules can enter cells.

Compare and contrast these two mechanisms.

(3)

. Diffusion is passive; it does not required energy, Active transport is active and requires energy from ATP.

. Diffusion is the net movement of molecules along the concentration gradient - from an area of high to low concentration. Active transport is the movement of molecules against the concentration gradient.

. Both the diffusion and the active transports mechanism is are the movement of molecules across a partially permiable membrane

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Examiner Comments

This response scored 3 marks. They have compared and contrasted the two mechanisms very clearly and show good exam technique.

They gave the two differences between diffusion and active transport and followed with the first similarity in the mark scheme.

(b) Diffusion and active transport are mechanisms by which molecules can enter cells.

Compare and contrast these two mechanisms.

(3)

Compare : both diffusion and active transport are ways of transportation of molecules into the cell through the cell membrane. Both facilitated diffusion and active transport need the help of carrier protein.

Contrast :	Diffusion	Active transport
	- Go along the concentration gradient, from a place of high concentration to a place of low concentration	- Go against the concentration gradient
	- Doesn't require energy	- Require energy (ATP)
	- Diffuse both ways	- Diffuse 1 way

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Examiner Comments

This was a response which met all four marking points and gained the maximum three marks.

They have written both similarities in the 'compare' section and differences in the 'contrast' section

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Examiner Tip

Writing contrasting statements in bullet points like this can help to ensure you make statements about both mechanisms.

(b) Diffusion and active transport are mechanisms by which molecules can enter cells.

Compare and contrast these two mechanisms.

(3)

- Diffusion and active transport both transport molecules across cell membrane
- Diffusion is with the concentration gradient from low to high whereas active transport is against concentration gradient.
- Diffusion is passive whereas so no ATP used whereas active transport uses a ATP

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Examiner Comments

This response makes an incorrect statement about diffusion and was not awarded mark point 3.

They did however gain mark point 1 and 4.

(b) Diffusion and active transport are mechanisms by which molecules can enter cells.

Compare and contrast these two mechanisms.

(3)

Diffusion is passive, whereas active transport is active and goes against the concentration gradient.
Active transport requires ATP but diffusion does not.
Both mechanisms transport molecules around the body.

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Examiner Comments

This is an example of a response where the candidate has not made a comparative statement.

They have stated that active transport goes against the concentration gradient, but not made a comparative statement for diffusion.

Question 2 (a)

This question required candidates to annotate correct symbols and charges on both hydrogen atoms and the oxygen atom.

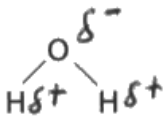
This was expected to be quite a straight forward question, but it proved to be a very good differentiator.

Almost a quarter of candidates did not gain a mark here. A small minority of candidates left this question blank, whereas other candidates either got the charges the wrong way round or drew hydrogen bonds linking this water molecule to another.

Of those that completed the diagram, 52% gained full marks for correctly annotating all symbols and charges.

Where one mark was awarded, candidates had usually annotated the charges correctly, but there were no symbols.

2 Water is a polar molecule. The diagram shows a molecule of water.



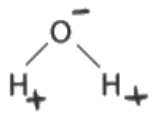
(a) Complete the diagram to show the dipole nature of this water molecule.

(2)

ResultsPlus
Examiner Comments

This response correctly annotated the diagram with three correct symbols and charges and scored full marks.

2 Water is a polar molecule. The diagram shows a molecule of water.



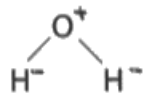
(a) Complete the diagram to show the dipole nature of this water molecule.

(2)

ResultsPlus
Examiner Comments

This is an example of the most common response that gained one mark. The candidate has placed correct charges on the diagram, but the symbols are missing.

2 Water is a polar molecule. The diagram shows a molecule of water.



(a) Complete the diagram to show the dipole nature of this water molecule.

(2)

ResultsPlus
Examiner Comments

This response scored 0 marks as the charges were incorrect.

Question 2 (b)

This question asked candidates to name the type of reaction in which a molecule of water is involved in the breaking of a bond in another molecule.

87% of candidates gave the correct answer of hydrolysis. Phonetically correct spellings were accepted.

(b) Name the type of reaction in which a molecule of water is involved in the breaking of a bond in another molecule.

(1)

hydrolysis

ResultsPlus
Examiner Comments

This was a correct answer and scored one mark.

(b) Name the type of reaction in which a molecule of water is involved in the breaking of a bond in another molecule.

(1)

condensation reaction

ResultsPlus
Examiner Comments

This is an example of the most common incorrect response.

(b) Name the type of reaction in which a molecule of water is involved in the breaking of a bond in another molecule.

(1)

Hydrophobic reaction

ResultsPlus
Examiner Comments

This was another incorrect response and scored 0 marks.

Question 2 (c)

This question asked candidates to explain how the properties of water make it an ideal transport medium.

This was a very good differentiator and the full range of marks was awarded. 10% of candidates gained full marks.

The first marking point was the most commonly awarded. This was usually for the reference of water being a good solvent.

Candidates tended to be vague in their answers and referred to substances or molecules dissolving in water. This was not sufficient as it needed to be polar molecules / ionic molecules or ions.

There were many references to cohesion or 'cohesive properties', but they had to be clear it was between water molecules in order to gain mark point 3.

(c) Explain how the properties of water make it an ideal transport medium.

(3)

Water is a dipolar molecule. It has a slightly positive hydrogen and slightly negative oxygen. This allows for substances water to become a universal solvent thus allowing transportation of substances, such as oxy

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Examiner Comments

This response gained the first mark point for water being a solvent.

(c) Explain how the properties of water make it an ideal transport medium.

(3)

Water is ideal as a transport medium as it can transport many molecules due to its dipole nature. Additionally it is difficult to be broken down, and because of the dipole nature it can surround other molecules causing them to dissolve and be transported by the water. This is also beneficial as water can move in and out of the cells via osmosis, which means dissolved molecules can be transported easily.

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Examiner Comments

This candidate has not referred to polar or ionic molecules and could not therefore be awarded either of the first two mark points.

(c) Explain how the properties of water make it an ideal transport medium.

(3)

because water is dipolar, it is polar, it can form hydrogen bonds between other molecules. This makes water a very good solvent as polar substances can dissolve in water by forming hydrogen bonds. In addition, water is both cohesive and adhesive since the hydrogen bonds in water allow them to stick together. This is useful for transporting substances such as mineral ions in plants through the transpiration stream. Water is also quite unreactive so it will not react with or alter the substances it is transporting.

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Examiner Comments

This response scored all three marks and gave both alternatives to mark point 1.

Question 3 (a)

This question asked candidates to calculate the mass of orange juice required to provide the same mass of vitamin C that is in 100g of blackcurrant juice.

This required candidates to extract two numbers from the graph for one mark: 52 and 180.

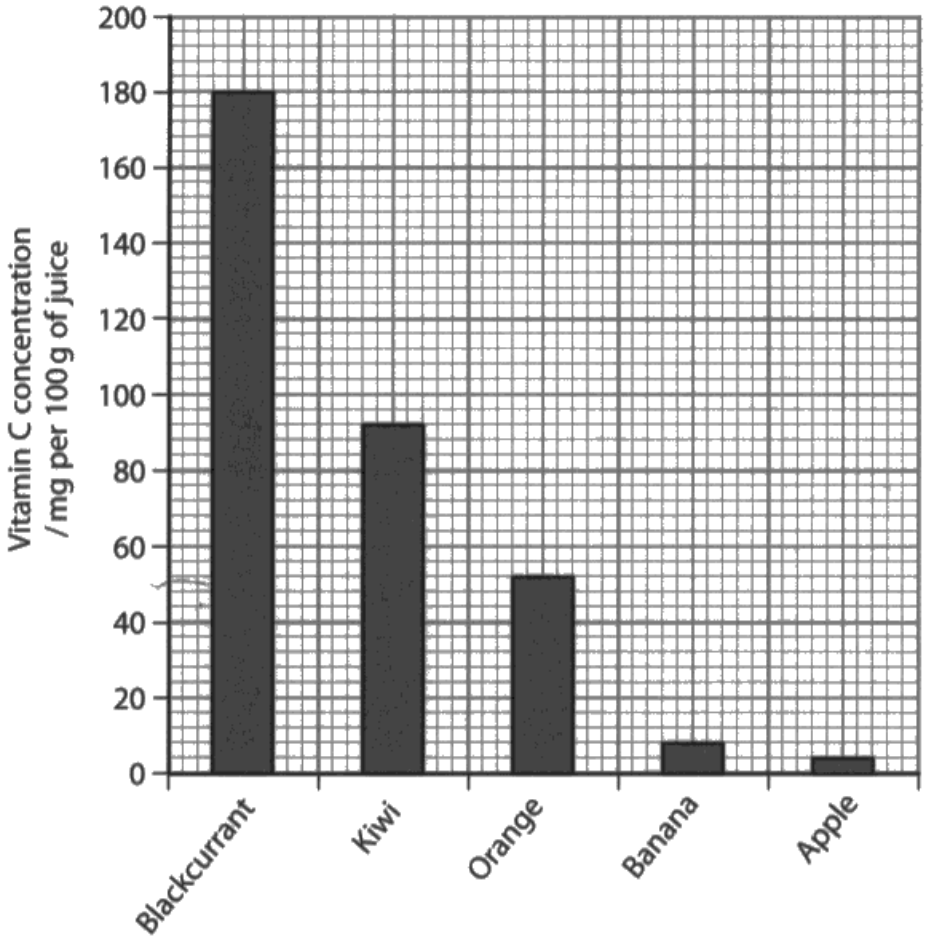
The candidates then had to use these two numbers to calculate the mass of orange juice required.

48% of candidates gave the correct answer and therefore scored full marks.

Where candidates scored 1 mark, this was usually for one of two reasons. Either they used an incorrect vitamin C concentration for orange juice in a correct calculation and gained one for error carried forward, or they subtracted 52 from 180.

3 Fruit juices contain various concentrations of vitamin C.

The graph shows the vitamin C concentration of five fruit juices.



52

(a) Calculate the mass of orange juice required to provide the same mass of vitamin C that is in 100 g of blackcurrant juice.

(2)

52
180/52 = 3.46

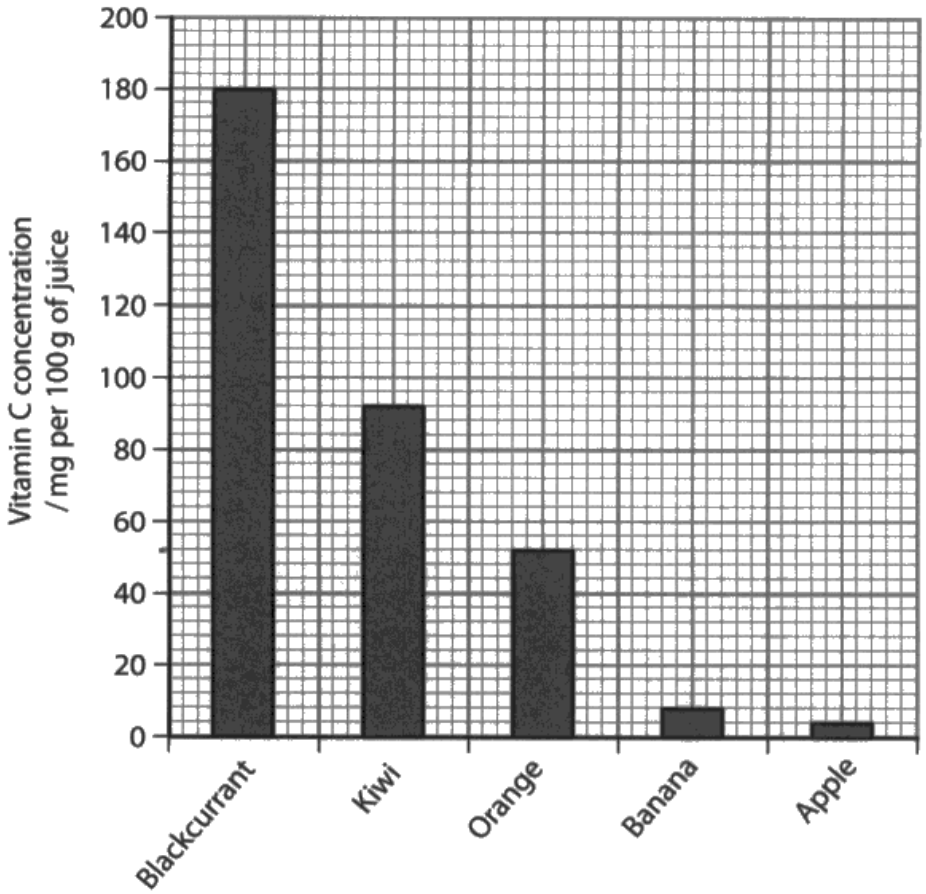
Answer 346 g

ResultsPlus
Examiner Comments

This is the correct answer and scored full marks.

3 Fruit juices contain various concentrations of vitamin C.

The graph shows the vitamin C concentration of five fruit juices.



(a) Calculate the mass of orange juice required to provide the same mass of vitamin C that is in 100 g of blackcurrant juice.

(2)

Oran→ 52 /mg

Blackc 180/mg

$\frac{180}{52} = 3.46$

180mg in 100 0.18g

52mg in 100 0.052g

Answer 3.46 g

ResultsPlus
Examiner Comments

The correct numbers have been extracted from the graph and used correctly. However the answer is for 1g of juice and not 100g and can not therefore be awarded full marks.

Question 3 (b)

The question required candidates to devise an investigation that could be used to collect the data that was shown in the graph. Candidates therefore needed to apply their knowledge of the core practical to this context.

It was clear from their responses that some candidates had not done this core practical.

The majority of candidates understood how to do a titration with DCPIP and were able to give this method to gain marking point 1 and 4. There were two possible methods for a titration with DCPIP. The method where the juice was poured into the burette was seen more commonly than the one where DCPIP was in the burette. This impacted on marking points 2 and 4.

However, some candidates described methods involving using a pipette to add drops of juice / DCPIP which was not credit worthy for mark point 1.

A significant minority of candidates referred to controlling the volume of juice, but could not be awarded mark point 2 as the volume of juice was their dependent variable in the method they gave. In this scenario, the idea of DCPIP decolourising could not be awarded.

When mark point 3 was awarded, it was usually for controlling the concentration of DCPIP or the age of the fruit juice.

Marking points 5 and 6 were very rarely awarded as candidates did not refer back to the graph and therefore did not explain how the concentration of vitamin C could be determined. Only 5% of candidates gained one or more of these marking points.

(b) Devise an investigation that can be used to collect these data.

(5)

- using a titration set up and using DCPIP solution you can see the overall volume of juice to change and colour of DCPIP solution from blue to colourless solution.
- Control variable : ensure that the total volume of DCPIP placed into beaker remains the same for each juice that you test to keep reliable results.
- Independent variable : using a range of different juices such as orange, banana, apple, kiwi and blackcurrant.
- Ensure that there are repeats to ensure that all results are reliable and accurate and that you can use it to make an average.
- Using titration method, ensure you read the titre of it, initially and after it has decolourised the DCPIP to see the amount of juice needed.

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Examiner Comments

This response gained three marks for a titration with a controlled volume of DCPIP which has a suitable end point.

The candidate has not controlled another variable or related the method to the data in the graph so mark points 3,5 and 6 could not be awarded.

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Examiner Tip

Make sure you describe variables which need to be controlled to ensure a valid investigation.

(b) Devise an investigation that can be used to collect these data.

(5)

In this experiment, the reagent used will be DCPIP solution which is blue but turns colourless in the presence of Vitamin C. A titration can be done, where the juice is placed in a burette. Underneath the burette, there should be a test tube with a set volume of DCPIP solution. The volume and concentration of the DCPIP solution should be kept the same for all 5 different juices. The juice should be added to the DCPIP drop by drop until the DCPIP becomes colourless. During this process, you should be shaking the test tube gently. Then, when the DCPIP turns colourless, record the volume of juice required to do so. You should aim to repeat this twice more and obtain an average in order to obtain more accurate results. Once you have obtained your results, then you can compare the volumes of fruit juices to a standard solution of vitamin C. Using ~~the standard~~ to the results for the standard solution, you can ~~find out~~ calculate the vitamin C content for all 5 juices. Other variables that should also be controlled include temperature which you could control by closing all doors and windows to prevent a draught.

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Examiner Comments

This response correctly describes an investigation that could be used to collect the data shown in the graph.

There is a titration with a known volume and concentration of DCPIP. The volume of juice needed to decolourise DCPIP is being measured and then compared to a standard solution of vitamin C.

Full marks were awarded.

Question 4 (a) (i)

This question asked candidates to state what is meant by the term allele and was a good differentiator.

Almost half of the candidates gained mark point 1 for correctly recognising that an allele is an alternative form of a gene.

A minority of candidates gained both marking points.

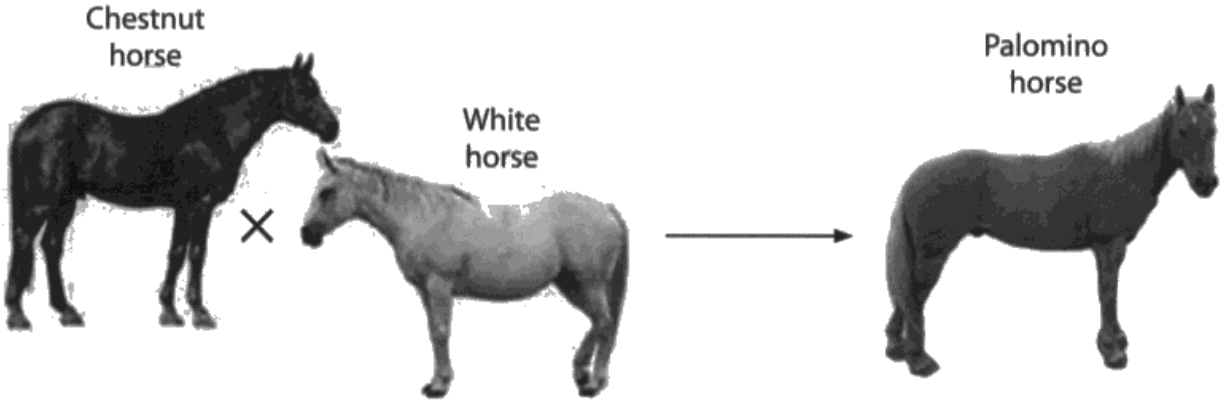
Some candidates gave a very good definition of a gene which was not credit worthy for this question.

4 The phenotype of organisms is affected by genotype.

(a) Chestnut horses are homozygous (recessive) for the allele H^C. White horses are homozygous for the allele H^W.

If a chestnut horse is mated with a white horse, the offspring will be palomino.

Palomino horses have coats with a colour intermediate between chestnut and white.



(i) State what is meant by the term **allele**.

(2)

A different version of a gene. Has the same locus.

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Examiner Comments

This response matched both marking points and was awarded 2 marks.

(i) State what is meant by the term **allele**.

(2)

A alternative version of a gene.

ResultsPlus
Examiner Comments

This response was awarded just mark point 1.

(i) State what is meant by the term **allele**.

(2)

Alleles are alternate versions of a gene found at the same place on a chromosome, and make up the genotype, and can be expressed in the phenotype.

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Examiner Comments

This response shows a clear understanding of the term allele and was awarded full marks.

(i) State what is meant by the term **allele**.

(2)

~~The two genes the organism has.~~

The two ~~genes~~ € genes the organism has.

ResultsPlus
Examiner Comments

This response does not give the meaning of the term allele and was awarded 0 marks.

ResultsPlus
Examiner Tip

Makes sure you understand the difference between a gene and an allele.

Question 4 (a) (ii)

This question related to the specification point about incomplete dominance. Candidates were given information about parental genotypes and the phenotypes for all the horses.

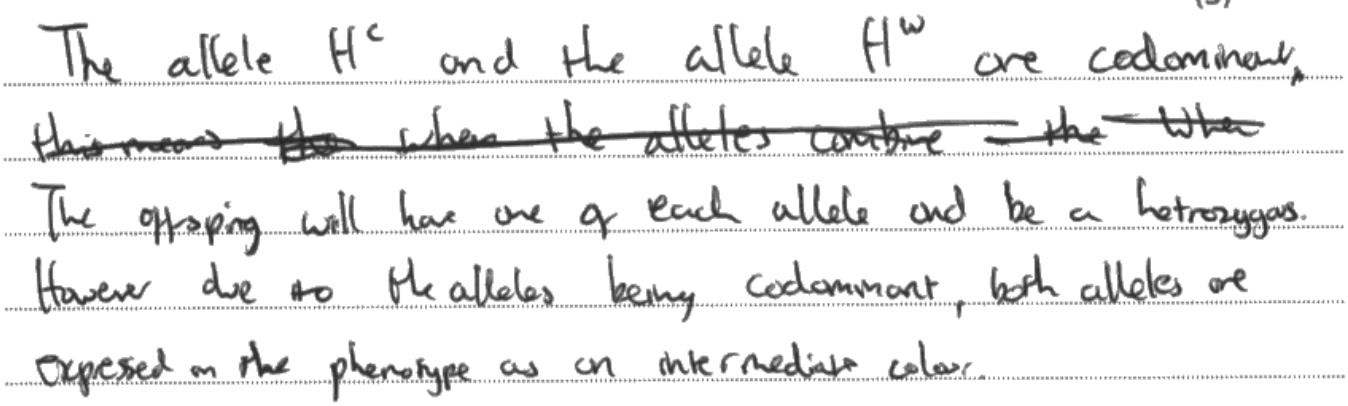
Candidates were therefore expected to recognise that the offspring would all be heterozygous for the two alleles given in the question information. The majority of candidates were awarded this marking point.

Fewer candidates were able to correctly explain why the heterozygous genotype would result in a palomino coat colour. The most common explanation was that both the alleles were dominant. This was not sufficient for mark point 2.

Mark point 3 was rarely awarded.

(ii) Explain why the offspring have the palomino coat colour.

(3)



ResultsPlus
Examiner Comments

This response was awarded full marks for a clear explanation of why the offspring had the palomino coat colour.

(ii) Explain why the offspring have the palomino coat colour.

(3)

The homozygous H^C allele and homozygous H^W allele can only be bred together and form heterozygous H^CH^W alleles for all offspring. This allele is neither dominant or recessive, and so characteristics of both are taken on. In this case, the white coat characteristic and chestnut coat characteristic are both inherited, creating a coat intermediate between chestnut and white.

ResultsPlus
Examiner Comments

This response gained the most commonly awarded marking point. They have correctly stated that the offspring would be heterozygous and therefore gained mark point 1.

(ii) Explain why the offspring have the palomino coat colour.

(3)

Incomplete dominance occurs, thus the offspring is a hybrid of both ~~the~~ their parents. This is because both parents are homozygous for their ~~allele~~ colour allele. Consequently, the offspring will inherit both characteristics.

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Examiner Comments

This response gained mark point 2 for correctly recognising that incomplete dominance was involved. However they have not stated the genotype of the offspring or referred to expression of both alleles and gained just one mark.

(ii) Explain why the offspring have the palomino coat colour.

(3)

- As Chesnut horses are homozygous H^c and white horses are homozygous H^w then all possible offspring must have a combination of both an allele for chestnut coat colour and also an allele for white coat colour.
- The resulting colour is palomino, a combination between both H^c and H^w alleles.

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Examiner Comments

This response correctly states that the offspring would have inherited one of each allele given in the information, but has not explained how this would result in the palomino coat colour. Just mark point 1 could be awarded.

Question 4 (b) (i)

This question required candidates to understand the information that was provided in the question in order to deduce whether achondroplasia is caused by a dominant or recessive allele.

The majority of students understood that it was caused by a dominant allele, however approximately a third of candidates thought it was recessive.

A number of candidates did not write either of these options which was very surprising as the choices were given in the question.

(b) Achondroplasia is a genetic condition that causes dwarfism in humans.

Genetic screening can be used to identify achondroplasia in embryos.

Individuals that are heterozygous for achondroplasia have shortened limbs.

Individuals homozygous for achondroplasia will not usually survive for more than one year.

(i) Deduce if achondroplasia is caused by a dominant or recessive allele.

(1)

dominant

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Examiner Comments

This response gained 1 mark for the correct answer. The candidate had read and understood the information provided.

(i) Deduce if achondroplasia is caused by a dominant or recessive allele.

(1)

dominant recessive

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Examiner Comments

Here the correct answer has been crossed out and replaced by an incorrect answer and therefore no marks could be awarded.

(i) Deduce if achondroplasia is caused by a dominant or recessive allele.

(1)

Recessive

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Examiner Comments

This was the most common incorrect answer.

Question 4 (b) (ii)

This question asked candidates to use a genetic diagram to determine the probability that a child of parents with achondroplasia will be homozygous for this condition.

Maximum marks could only be awarded if there was a correct genetic diagram as well as a correct probability. A small minority of candidates just gave a probability or used an inappropriate diagram and therefore could not access marking points 1 or 2.

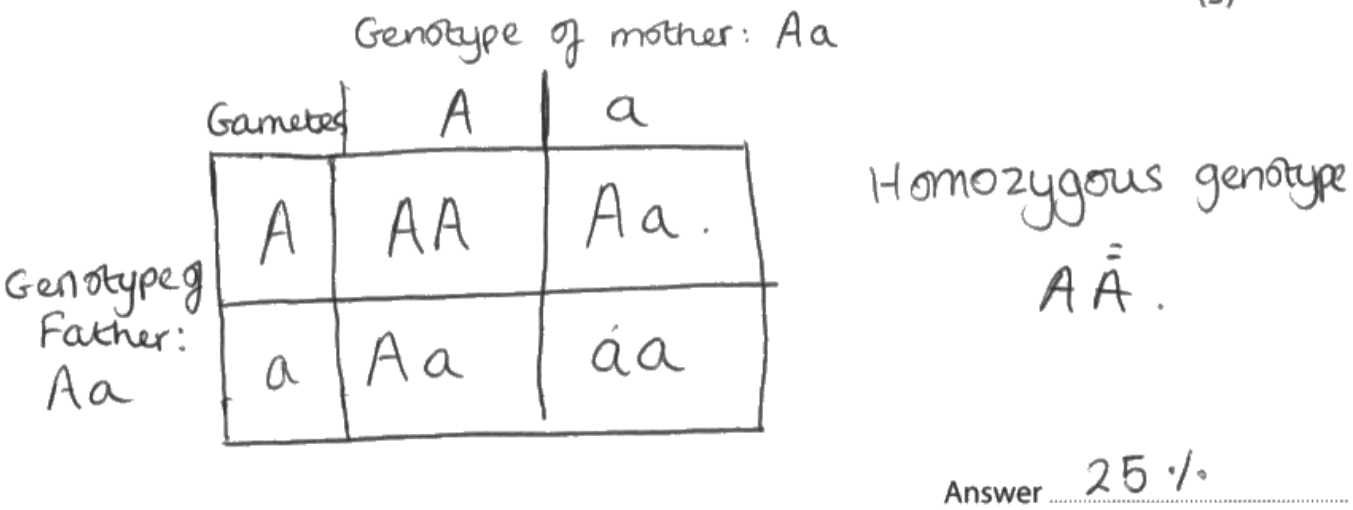
Error carried forward could be applied as the question was testing several different skills. For example, a candidate who gave incorrect parental gametes but completed the genetic diagram correctly using the gametes could still be awarded mark point 2.

It was pleasing to see that the vast majority of candidates understood the term probability and therefore very few ratios were seen.

A minority of candidates gave the probability of both homozygous dominant and homozygous recessive which was not credit worthy for mark point 3.

(ii) Use a genetic diagram to determine the probability that a child of parents with achondroplasia will be homozygous for this condition.

(3)



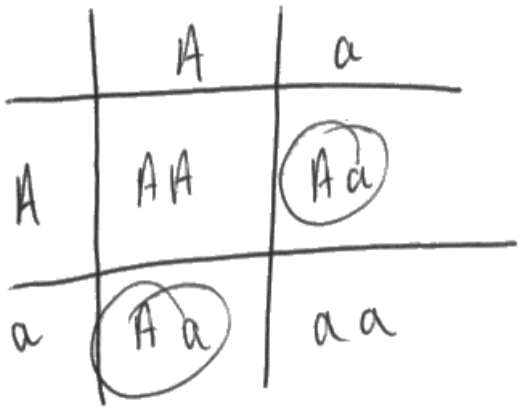
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Examiner Comments

This response gained full marks.

Both parents were heterozygous, correct offspring genotypes in a suitable genetic diagram and the correct probability.

(ii) Use a genetic diagram to determine the probability that a child of parents with achondroplasia will be homozygous for this condition.

(3)



Answer 50 %.

ResultsPlus
Examiner Comments

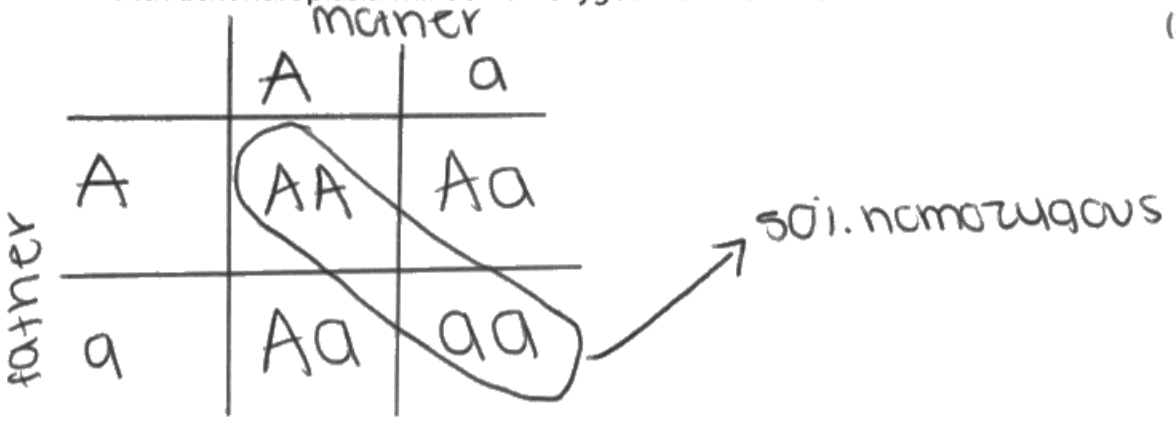
This response scored 2 marks.

Both parents heterozygous and the correct offspring genotypes are present in a suitable genetic diagram.

However, they have given the probability of being heterozygous instead of homozygous for this condition and therefore were not awarded mark point 3.

(ii) Use a genetic diagram to determine the probability that a child of parents with achondroplasia will be homozygous for this condition.

(3)



parent phenotype affected affected
" genotype Aa Aa
gametes A a A a
AA Aa Aa aa

Answer 50%

ResultsPlus
Examiner Comments

This response scored 2 marks.

Both parents heterozygous and the correct offspring genotypes in a suitable genetic diagram.

However they have given the probability of being both homozygous recessive and homozygous dominant and therefore were not awarded mark point 3.

Question 4 (b) (iii)

This question required candidates to identify the type of genetic screening which would take place on an embryo, created by IVF, before it is placed in the mother's uterus. The correct answer was pre-implantation genetic diagnosis.

This was surprisingly poorly answered by many candidates, with just over half of the candidates scoring 0 marks. A significant minority of answers showed that the candidates did not read the question properly and gave screening that would happen after the embryo had been placed in the mother's uterus.

Common incorrect answers were prenatal genetic screening, CVS, chronic villus sampling and amniocentesis.

Correct abbreviations were acceptable for the mark. However, a minority of responses that gave abbreviations as their answer, got the letters the wrong way round and could not therefore be awarded the mark.

(iii) An embryo, created by IVF, can be screened before it is placed in the mother's uterus.

Name this type of genetic screening.

(1)

Embryonic screening

ResultsPlus
Examiner Comments

This was an incorrect answer and scored 0 marks.

(iii) An embryo, created by IVF, can be screened before it is placed in the mother's uterus.

Name this type of genetic screening.

(1)

Pre-implantation genetic screening.

ResultsPlus
Examiner Comments

This answer scored one mark for correctly identifying the genetic screening that could be carried out on the embryo before it was placed in the uterus of the mother.

(iii) An embryo, created by IVF, can be screened before it is placed in the mother's uterus.

Name this type of genetic screening.

(1)

PGD

ResultsPlus
Examiner Comments

This was a correct answer and scored 1 mark.

(iii) An embryo, created by IVF, can be screened before it is placed in the mother's uterus.

Name this type of genetic screening.

(1)

Pre-natal screening

ResultsPlus
Examiner Comments

This was a common incorrect answer.

Question 4 (b) (iv)

This question asked candidates to explain an ethical issue relating to the use of prenatal genetic screening. This term was used so that candidates could talk about embryos screened by PGD, as well as CVS and amniocentesis.

There was a wide variation in the quality of responses to this question and the whole range of marks were awarded.

There was a significant number of responses that correctly recognised that a positive result could lead to the parent(s) choosing to have an abortion or IVF embryos being discarded. However, fewer candidates accessed the second marking point. Explanations such as 'playing God' or religious beliefs were too vague to be awarded marking point 2.

A similar proportion of candidates correctly recognised that sometimes there could be an incorrect test result. However, sometimes they linked a false negative to the abortion of a healthy foetus which was incorrect and therefore also could not be awarded mark point 2.

A minority of candidates referred to designer babies which was not credit worthy.

(iv) Explain **one** ethical issue relating to the use of prenatal genetic screening.

(2)

You can have a false positive, meaning the mother could have aborted the foetus thinking it has a condition / disease, but in fact they would have aborted a completely fine foetus.

As well, there are lots of ethical and religious issues in regards to choosing to abort, if the foetus has a genetic condition.

ResultsPlus
Examiner Comments

This response scored full marks as they correctly linked a false positive result to a possible abortion of a healthy foetus.

(iv) Explain **one** ethical issue relating to the use of prenatal genetic screening.

(2)

Parents are able to chode the features and characteristics for their which some people say is an intervention into the natural process of conciening and is said to be 'playing God' as people shouldn't have the right to choose.

ResultsPlus
Examiner Comments

This response scored 0 marks as they have not explained an appropriate ethical issue.

(iv) Explain **one** ethical issue relating to the use of prenatal genetic screening.

(2)

- If mother finds out that baby has genetic disorder, she may decide to go for an abortion, which many people find unethical for religious regions or the fact that they believe no living thing should be killed.

ResultsPlus
Examiner Comments

This response scored 2 marks for the first pair of marking points on the mark scheme.

(iv) Explain **one** ethical issue relating to the use of prenatal genetic screening.

(2)

It is ~~we~~ considered unethical if parents abort a fetus because it has a genetic disorder.

ResultsPlus
Examiner Comments

This response gained 1 mark for correctly identifying an appropriate ethical issue. However, they have not explained why it is unethical.

ResultsPlus
Examiner Tip

Look carefully at the command words in the question.

Question 5 (a) (i)

Candidates were provided with two graphs. Both showed the changes in blood pressure in one side of the heart over the same time period.

Candidates were asked to analyse the graphs and then calculate the heart rate. The unit was not given on the answer line.

50% of candidates gained two marks for correctly stating that the heart rate was 75bpm.

The most common reason why candidates were awarded only one mark was for giving the correct heart rate but without the unit.

(a) (i) Calculate the heart rate.

(2)

0.9 - 0.1 = 0.8

60 / 0.8 = 75

Answer 75

ResultsPlus
Examiner Comments

This is an example of a correct heart rate which could not be awarded full marks as the unit was not given.

ResultsPlus
Examiner Tip

If there is not a unit on the answer line, then you should check to see if it would be appropriate to give one.

(a) (i) Calculate the heart rate.

(2)

One cycle = 0.8s

60 ÷ 0.8 = 75

75 bpm

Answer 75 bpm

ResultsPlus
Examiner Comments

This response scored both marks. They have given the correct heart rate and the appropriate unit.

Question 5 (b) (i)

This question asked candidates to explain which side of the human heart is represented by graph B.

This seemed to pose few problems for the candidates and many gave a far more detailed explanation that was needed for the 2 marks. Explanations included details of why the blood pressure would be lower, for example to prevent damage to the lungs.

Where full marks were not awarded, this was often due to reference to blood having to only travel to the lungs, but without reference to blood pressure.

Very few candidates incorrectly stated that it was the left side of the heart.

(b) (i) Explain which side of the human heart is represented by graph B.

(2)

Left because the atria will be relaxing and the ventricles would be contracting.

ResultsPlus
Examiner Comments

This is an example of a rare occurence where the incorrect side of the heart was stated. Therefore 0 marks could be awarded.

(b) (i) Explain which side of the human heart is represented by graph B.

(2)

Right side as pressure is low as the blood on the right side is going to travel a shorter distance to the lungs.

ResultsPlus
Examiner Comments

This is an example of a response which gained full marks.

Question 5 (b) (iii)

This question was a very good differentiator as it required candidates to correctly analyse the graph and apply their knowledge of the cardiac cycle to this context.

Candidates were able to give a good description of events that occur in the cardiac cycle but the majority of candidates were not able to link correctly to graph A. This limited the number of marks that could be awarded. Candidates should be able to apply their knowledge to the given context.

Many candidates did not recognise that the question was just asking about changes in the ventricle pressure and gave information about pressure changes in the atria and aorta. They gave detailed descriptions of times when valves open and close and the pressure differences that caused this to happen.

The most commonly awarded mark point was mark point 2 as it did not require candidates to give a correct time from the graph.

The main reasons why mark points 4 and 5 were not awarded more often was either due to incorrect times being given from the graph or no timings being given at all.

(iii) In graph A, the blood pressure inside the ventricle changes between 0.0 and 0.45 seconds.

Explain how these changes in blood pressure occur in this part of the cardiac cycle. (4)

Atrial systole raises pressure blood in the atria which opens the atrioventricular valves and the blood runs into the ventricles where ventricular systole and squeezes takes place where contraction or increases the blood pressure in the ventricles opens the atrioventricular valve so the blood exits, decreasing pressure.

ResultsPlus
Examiner Comments

This is an example of a response where only mark point 2 could be awarded as the candidate has not referred to the graph.

ResultsPlus
Examiner Tip

Use the data you have been provided with to help give detail to your explanations.

(iii) In graph A, the blood pressure inside the ventricle changes between 0.0 and 0.45 seconds.

Explain how these changes in blood pressure occur in this part of the cardiac cycle.

(4)

* The ~~change~~ increase in blood pressure at 0.1 seconds occurs because of ventricular systole as the walls of the ventricle ~~cells~~ contract, increasing the pressure. ~~As~~ ~~that~~ ~~the~~ This increase in pressure slows down at 0.18 seconds because the semi-lunar valve has opened, allowing the high pressure blood to be pumped into the aorta. At 0.32 seconds, ~~and~~ the blood pressure starts decreasing as the walls of the ventricle are ~~relax~~ recoiling in ~~ventricular~~ diastole. At 0.4 seconds the semilunar valve shuts as aortic blood pressure is higher than the blood in the ventricle.

* At 0 seconds the ventricular blood pressure increases slightly as blood flows into the ventricle due to atrial systole.

ResultsPlus
Examiner Comments

This is an example of a response which scored full marks. They have clearly explained how the changes in the blood pressure in the ventricle have occured and used correct timings from the graph.

ResultsPlus
Examiner Tip

If you miss a detail out of your answer and write it in lower down, it is a good idea to indicate where it should go for a logical flow.

Question 5 (c)

This question asked candidates to explain how the structure of the walls of the blood vessels carrying blood away from the heart in graph A and graph B are different and proved to be a very good differentiator.

A small minority of candidates either compared an artery and a vein or the two sides of the heart.

Just over 10% of candidates gained full marks.

Where full marks were not awarded, it was generally for imprecise explanations. Many candidates did not give a comparative answer for mark point 1 and therefore could not gain the mark. Some candidates referred to lumen size which was not credit worthy for this particular question. A surprising number of candidates referred to elastic muscle or 'coping with high blood pressure'.

(c) **Explain how the structure of the walls of the blood vessels carrying blood away from the heart in graph A and graph B are different.**

(3)

In graph A the blood is carried through away from the heart through the aorta which is an artery. The ~~artery~~ aorta has a narrow lumen ~~whi~~ in order ~~to help~~ hold for a higher pressure ~~in~~ and has thick muscular walls in order to prevent rupture of the ~~artery~~ aorta. The walls of the aorta are also contain elastic ~~tissue~~ tissue and this is for recoil and ~~also~~ also so that the ~~aorta~~ aorta can ~~stretch~~ Stretch ~~in order to allow~~ for ~~the~~ also stretch. The ~~veins carry blood away from the heart at~~ pulmonary artery carries blood away from the heart at graph B and it has a wider lumen so that the blood can travel at a lower pressure and so the ~~wall~~ walls are also thinner.

ResultsPlus
Examiner Comments

This response gained one mark for giving the function of the elastic tissue. Comparative language was not used and the function of the muscular tissue in maintaining high blood pressure was not given.

The information about lumen size was not relevant to this question.

ResultsPlus
Examiner Tip

Read the question carefully to ensure you are giving the required information.

(c) Explain how the structure of the walls of the blood vessels carrying blood away from the heart in graph A and graph B are different.

(3)

In Graph A, the aorta takes the blood away from the heart. In Graph B the pulmonary arteries takes the blood away from the heart.

The aorta has thick muscular walls to withstand the high blood pressure it has to supply the whole body with. ~~While the pulmonary arter~~ Pulmonary arteries also have thick muscular walls to withstand the high pressure. They both have elastic fibres to withstand high blood pressure by stretching and recoiling. They both have an smooth endothelium lining in the wall to prevent friction from high blood pressure.

ResultsPlus
Examiner Comments

This response explains the similarities between the walls of the blood vessels and not the differences.

They gained mark point 4 for the recoil of elastic tissue.

ResultsPlus
Examiner Tip

Ensure you are answering the actual question asked.

Question 6 (b)

The candidates were given some information about the composition of a layer of surfactant found in the alveoli. They were told that it contained proteins and lipoproteins. They were given data to analyse regarding the percentage fluorescence inside and outside the alveolar cells due to marked amino acids.

The majority of candidates were expected to be able to describe that the percentage of fluorescence decreased inside the cell or that it increased outside the cell. However, it was surprising how few candidates did this.

It was also surprising that around a third of candidates gained no marks at all as they simply stated that the amino acids would have diffused out of the alveolar cells.

Candidates were expected to be able to link the pieces of information together to understand that the amino acids were being used in protein synthesis and that some proteins were entering the surfactant fluid via exocytosis. A pleasing number of high quality answers were seen which gave detailed explanations of why the fluorescence changed inside and outside the alveolar cells.

The most commonly awarded mark was for candidates recognising that the amino acids were used in protein synthesis, whereas only a few candidates tried to explain why there was still 38% fluorescence in the cells after 25 minutes.

(b) The percentage of fluorescence inside and outside these alveolar cells changed.

Explain why these changes occurred.

(4)

The amino acids ~~binds to the~~ are binded to the tRNA responsible for carrying the complimentary bases for the mRNA bases responsible for coding the sequence.

During translation, these amino acids are joined together to make a polypeptide chain, via condensation reaction forming peptide bonds.

these move to the golgi apparatus and added a lopid group. They then ~~are~~ are enclosed in a vesicle and via exocytosis leaves the cell to the membrane.*

These proteins have amino acids which is tagged with fluorsence. Thus they can be seen moving from the cytoplasm to the outside on the membrane.

* they are transported out of the cell.

ResultsPlus
Examiner Comments

This response did not state how the fluorescence changed during the experiment.

However, it gained 3 marks for describing how the amino acids would be used in protein synthesis and the process of exocytosis.

(b) The percentage of fluorescence inside and outside these alveolar cells changed.

Explain why these changes occurred.

(4)

They changed because the amino acids exited the alveolar cells. Protein ~~s~~ synthesis was occurring, so during translation amino acids were forming peptide bonds to create polypeptide chains and ultimately proteins. These proteins (with the fluorescent ~~amine~~ amino acids) would leave the cell via exocytosis. They would be packaged in a vesicle at the golgi apparatus, then the vesicle would move to the membrane of the cell. The vesicle would fuse with the membrane and the protein, containing the fluorescent amino acid would leave. This decreased the % percentage of fluorescence inside the alveoli, since the amino acids left these cells, and increased the fluorescence outside since the protein containing the fluorescent amino acids were secreted outside the cells.

ResultsPlus
Examiner Comments

This response shows clear understanding of the information provided and application of relevant knowledge to explain why the percentage of fluorescence changed.

Marking points 1,2,3,4 were awarded.

(b) The percentage of fluorescence inside and outside these alveolar cells changed.

Explain why these changes occurred.

(4)

Diffusion which is the movement of molecules from an area of high concentration to low concentration (down a concentration gradient) has allowed this to happen.

ResultsPlus
Examiner Comments

This is an example of a common incorrect answer referring to diffusion of amino acids out of the cell.

Question 6 (c)

This question asked candidates to explain how these labelled amino acids would be incorporated into a surfactant protein and was a very good differentiator.

Some candidates referred to the amino acids joining to a pre-existing surfactant protein which was not credit worthy.

The most commonly awarded marking point was number 4. Marking point 5 was the next most commonly awarded as many recognised that the primary structure would not be the final structure of a surfactant protein. Around half of candidates did not include any more details of translation.

When candidates did include some detail about events that occur at the ribosome, imprecise language often prevented them gaining marks. For example, they would not refer to codons or anticodons - mRNA finding a ribosome was also not sufficient.

(c) Explain how these labelled amino acids would be incorporated into a surfactant protein.

(4)

The amino acids would join together in a condensation reaction ~~forming peptide bonds~~ by peptide bonds to create a polypeptide chain. This would then get folded into either an α helix or β pleated sheet and then get folded into a tertiary structure with different bonds between R groups for example Hydrogen bonds or ionic bonds. The bonding between R groups will determine the protein made, in this case a surfactant protein.

ResultsPlus
Examiner Comments

This is an example of a response which gained 2 marks for the most commonly awarded marking points.

(c) Explain how these labelled amino acids would be incorporated into a surfactant protein.

(4)

* A mRNA (produced in the nucleus) leaves the nucleus and enters the cytoplasm.
* It attaches to a ribosome.
* tRNA in the cytoplasm binds to the labelled amino acids specific to that tRNA binding site.
* a tRNA carrying an amino acid binds it's anti-codon to the corresponding codon on the mRNA strand.
* A second tRNA molecule attaches to the mRNA strand.
* A peptide bond forms between consecutive amino acids.
* As the ribosome moves along the mRNA, the tRNA leave the strand.
* This continues until a stop codon is reached.
* The protein formed detaches itself and is transported to the golgi body to be packaged & modified.
* The protein contains the labelled amino acids

ResultsPlus
Examiner Comments

This response gained the first four marking points. They have described the process of translation clearly.

However, they did not go on to explain how the primary structure of the polypeptide would be changed to form a surfactant protein's tertiary structure.

ResultsPlus
Examiner Tip

Think about why certain terminology is used in the question.

Question 7 (a) (i)

This question presented candidates with results from an investigation.

Candidates were asked to determine the effect of salt in the diet on systolic blood pressure in the investigation. In order to do this, candidates had to analyse the data correctly and have an element that was quantitative from the stimulus provided.

Approximately 20% of candidates gained one mark. This was usually for recognising that a high salt diet would increase blood pressure. Many candidates did not recognise that the command word 'used' required them to give a quantitative element to their answer and therefore did not state how much the blood pressure would increase by. Of those candidates that did give a quantitative element to their answer, a significant number did not read numbers from the graph correctly.

A significant minority of candidates stated that the blood pressure in group A decreased, which was incorrect.

(a) (i) **Determine the effects of salt in the diet on systolic blood pressure in this investigation.**

(3)

We can see that group A with a diet of 5g of salt per day had a very stable blood pressure averaging around 120 mmHg. This however in group B can a fairly linear correlation can be seen showing how systolic blood pressure increased by 32 mmHg over a year. This indicates that regular high levels of salt cause blood pressure to increase seen by how group A had a low amount and remained stable with little change but group B with a high salt diet had a large increase in blood pressure.

ResultsPlus
Examiner Comments

This response clearly describes the effects of salt in the diet on the systolic blood pressure and gained all three marks.

(a) (i) Determine the effects of salt in the diet on systolic blood pressure in this investigation.

(3)

As larger amounts of salt cause an increase in mean systolic blood pressure 3g of salt a day doesn't cause much difference in mean systolic blood pressure for 9g as months go on the mean systolic blood pressure increases. This shows higher levels of salt increase blood Dressure in the body.

ResultsPlus
Examiner Comments

This response gained mark points 1 and 2 for a correct description of the effects of the 2 salt diets on systolic blood pressure. However they have not manipulated any of the given data to provide a quantitative aspect to their answer.

ResultsPlus
Examiner Tip

Think about the choice of command word - what is it requiring?

Question 7 (a) (ii)

This question asked candidates to explain the effect that a diet high in salt could have on a person's risk of developing cardiovascular disease and was generally very well answered.

Almost a third of candidates gained full marks on this question.

The majority of candidates started their answer with a statement about how the risk would be increased which showed good exam technique.

The majority of candidates used their answer from 7(a)(i) and referred to high salt intake causing a higher blood pressure to gain marking point 2. They then followed it with marking points 3,4 and 5.

It was pleasing to see an improvement in the quality of candidate responses about this specification point from previous years. Significantly more candidates were being more specific and referring to endothelium of an artery.

(ii) Explain the effect that a diet high in salt could have on a person's risk of developing cardiovascular disease.

(5)

A diet high in salt could increase the risk of cardiovascular disease. This is because salt is a facter of blood pressure. An increase in a high concentration of salt increases the mean systolic blood pressure as it did for group B. An increase in blood pressure will contribute to an increased risk of CVD as it increases the formation of ameroma in the arteries which results in atherosclerosis. Atherosclerosis results in an increase in the blockage of arteries due to fatty plaques being formed which leads to an increased risk of a person developing heart disease.

ResultsPlus
Examiner Comments

This response shows good practice in that it immediately identifies that the risk of developing CVD would be increased.

They have linked high blood pressure to atheroma formation and atherosclerosis to gain 4 marks.

(ii) Explain the effect that a diet high in salt could have on a person's risk of developing cardiovascular disease.

(5)

* increased risk of developing cardiovascular disease.
* high blood pressure increases risk of developing cardiovascular disease, & a diet high in salt can cause high blood pressure, increasing risk of developing CVD.
* diets high in salt also tend to be high in fat, which lead to increased risk of blockage in blood vessels. This can also increase blood pressure as the lumen of the vesel narrows. & This increases risk of developing CVD.

ResultsPlus
Examiner Comments

This response gained 2 marks for identifying the increased risk of developing CVD and that the high salt diet would result in high blood pressure.

They did not gain mark point 6 as they had to be specific that it would be arteries that would be narrowed. Blood vessels was insufficient.

There were no details of how high blood pressure could cause atherosclerosis.

(ii) Explain the effect that a diet high in salt could have on a person's risk of developing cardiovascular disease.

(5)

[redacted] - a high intake of salt has more sodium in it, therefore it can increase blood pressure

ResultsPlus
Examiner Comments

This short response has not actually answered the question asked.

They did gain one mark for identifying that the blood pressure would increase as a result of a high salt diet.

(ii) Explain the effect that a diet high in salt could have on a person's risk of developing cardiovascular disease.

(5)

Having a high salt intake could increase the blood pressure. Increasing the blood pressure could mean that there's a higher chance of the endothelial lining in the coronary artery becoming damaged. This leads to an inflammatory response, where white blood cells engulf lipids, becoming foam cells, and depositing fatty tissues on the endothelial lining. Calcium salts and fibrous tissue form on these fatty deposits, forming plaque. This causes the lumen of the artery to narrow, and arteries to harden. The arteries cannot stretch and recoil to withstand high blood pressure, and the lumen becomes partially blocked. Therefore, ~~less oxygen~~ blood flow is restricted and less glucose and oxygen can reach the cardiac cells. The cardiac cells can die, which can lead to myocardial ~~infac~~ infarction.

ResultsPlus
Examiner Comments

Although this response does not state the effect on the risk of developing CVD, they do gain full marks from marking points 2-6.

Question 7 (b)

This question asked candidates to explain how the validity of the investigation, described at the start of the question, could be improved.

It was pleasing to see a large number of candidates referred back to the details of the investigation and recognised that the number of males and females were uneven and that there was a small sample size. These were the most commonly awarded marks.

As the question had specifically stated 'this' investigation, improvements relating to different investigations that could be carried out were not credit worthy. A significant minority of candidates did explain suitable improvements that would improve the validity of the investigation.

Approximately 10% of candidates gained full marks on this question.

(b) Explain how the validity of this investigation could be improved.

(3)

They should aim to compare the same amount of females to males e.g 15 female and 15 males. They can also increase the variation of salt tested, e.g 3g, 6g and 9g to investigate how much BP increases. Increasing the sample size to include more individuals as the effect may be varying so a larger sample size increases validity.

ResultsPlus
Examiner Comments

This response gained the most commonly awarded marking points; the equal numbers of males and females and the larger sample size.

Increasing the variation of salt diets was not relevant.

(b) Explain how the validity of this investigation could be improved.

(3)

An equal number of men and women could be used so that the results are representative of both sexes. Also, a larger sample could be used because 20 people is quite a small sample. Also, ~~select participants~~ arrange the participants so that they are matched on their blood pressure, so that both groups start with the same mean blood pressure

ResultsPlus
Examiner Comments

This response gained full marks for a clear explanation of how the validity of this investigation could be improved.

Question 7 (c)

This question asked candidates to state two possible side effects of taking drugs to reduce blood pressure. These drugs are antihypertensives.

This meant side effects of anticoagulants, platelet inhibitors and statins were not relevant.

It was concerning that many candidates ignored the requirement to state TWO side effects and gave more in their answer. The list rule was not applied here, but if it had been, many candidates would have gained fewer marks as a result.

The most commonly given side effects were nausea and dizziness.

(c) A variety of drugs can be used to reduce blood pressure. These drugs may cause side effects in some people.

State **two** possible side effects of taking drugs to reduce blood pressure.

(2)

Dizziness and narsea.

ResultsPlus
Examiner Comments

These are the most commonly given correct side effects and scored 2 marks.

(c) A variety of drugs can be used to reduce blood pressure. These drugs may cause side effects in some people.

State **two** possible side effects of taking drugs to reduce blood pressure.

(2)

drugs can become addictive leading to an overdose.

ResultsPlus
Examiner Comments

This scored 0 as it was not a credit worthy side effect.

(c) A variety of drugs can be used to reduce blood pressure. These drugs may cause side effects in some people.

State **two** possible side effects of taking drugs to reduce blood pressure.

They may cause nausea and vomiting (2)
as well as anticoagulants which are used to reduce blood clots and eventually pressure may cause internal bleeding.

ResultsPlus
Examiner Comments

Nausea and vomiting were the same marking point.

The side effects of anticoagulants were not credit worthy as they were asked to state side effects of antihypertensives.

Question 8 (b)

This question gave candidates information about cystic fibrosis mutations and asked them to explain why thicker mucus would be produced if the functioning of the CFTR channel protein was impaired.

This question was a good differentiator with a third gaining 0 marks, a third gaining 1 mark and a third gaining both marks.

The most commonly awarded marking point was for explaining that chloride ions would not be able to leave the cell / enter the mucus. A small minority of candidates referred to chlorine and therefore could not gain the mark. The most common reason why this mark was not awarded was for saying that chloride ions would not be able to pass through the channel protein, but without stating the direction.

The second most commonly awarded marking point was marking point 3. Most candidates explained that the water does not move into the mucus by osmosis. A significant number of candidates however, did not refer to osmosis and could not be awarded the mark.

(b) More than 1500 mutations have been found for the gene that codes for the production of the CFTR channel protein.

Some of these mutations cause cystic fibrosis by affecting the production or functioning of the CFTR channel protein.

If the functioning of the CFTR channel protein is impaired, thicker mucus is produced in the lungs.

Explain why thicker mucus is produced if the functioning of the CFTR channel protein is impaired.

(2)

*If the functioning of the CFTR protein is impaired, then less chloride ions can leave the cells and go into the mucus.

*As a result, less water leaves the cells by osmosis to go into the mucus, so if the mucus has less water, it's more thick and sticky.

ResultsPlus
Examiner Comments

This response gained marking points 1 and 3 and scored 2 marks.

(b) More than 1500 mutations have been found for the gene that codes for the production of the CFTR channel protein.

Some of these mutations cause cystic fibrosis by affecting the production or functioning of the CFTR channel protein.

If the functioning of the CFTR channel protein is impaired, thicker mucus is produced in the lungs.

Explain why thicker mucus is produced if the functioning of the CFTR channel protein is impaired.

(2)

This impairment means that the Cl^- ions cannot pass through the CFTR channel protein and enter the mucus.

- This means the Na^+ ions also ~~were~~ doesn't are able to follow into the mucus to balance Cl^- charge.
- This means water is not drawn via osmosis (movement from low concentration of solute to high concentration of solute) resulting in a mucus with little water within it.

ResultsPlus
Examiner Comments

This is a response which met all three marking points to score the maximum two marks. This candidate gave extra details which demonstrates their secure understanding of this part of the specification.

(b) More than 1500 mutations have been found for the gene that codes for the production of the CFTR channel protein.

Some of these mutations cause cystic fibrosis by affecting the production or functioning of the CFTR channel protein.

If the functioning of the CFTR channel protein is impaired, thicker mucus is produced in the lungs.

Explain why thicker mucus is produced if the functioning of the CFTR channel protein is impaired.

(2)

This is because the ~~osmosis cannot~~ CFTR protein cannot transport ~~chloride~~ Chloride ions which result in the mucus being watery due to osmosis. If the CFTR is impaired chloride ions cannot be transported which leads to osmosis not occuring resulting in more mucus.

ResultsPlus
Examiner Comments

This response did not gain any marks as there was a lack of details about the direction of movement of the chloride ions and water molecules.

Question 8 (c)

This question tested two different maths skills, one of which had not been tested previously.

Candidates were given some information about a sample of people with cystic fibrosis that was studied in 2013 and an incomplete table of data. They had to calculate the percentage of people with each mutation.

The candidates then needed to recognise that this was discontinuous data in order to plot a suitable graph.

It was surprising that 40% of candidates lost marks on this question. Some candidates did not calculate the percentages correctly, although they could still access both marking points in (c)(ii) due to ECF being applied. Some candidates did not choose a suitable graph, whereas others did not plot their calculated percentages correctly. The most common reason however, was for incorrect labelling of the axes.

(c) In 2013, in the UK, a sample of 10 500 people with cystic fibrosis was studied.

The numbers of people with the three most common mutations of the CFTR gene are shown in the table.

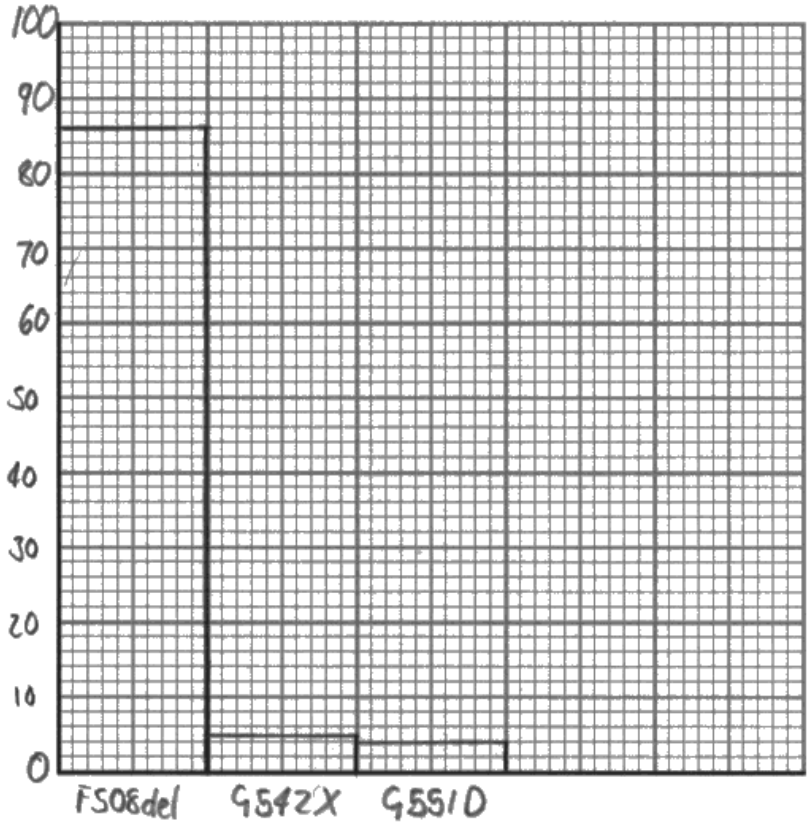
Mutation	Number of people with the mutation	Percentage of people with the mutation (%)
F508del	9030	86
G542X	525	5
G551D	420	4

(i) Complete the table to show the percentage of people with each mutation.

(1)

(ii) Plot a suitable graph to show the percentage of people with these mutations.

(2)



ResultsPlus
Examiner Comments

This candidate correctly calculated the percentages to gain one mark for (c)(i) and plotted them correctly to gain the second mark for (c)(ii).

However, this graph did not gain the first marking point for (c)(ii) as they did not label the axes appropriately.

ResultsPlus
Examiner Tip

Use the headings of the table as axes labels.

(c) In 2013, in the UK, a sample of 10 500 people with cystic fibrosis was studied.

The numbers of people with the three most common mutations of the CFTR gene are shown in the table.

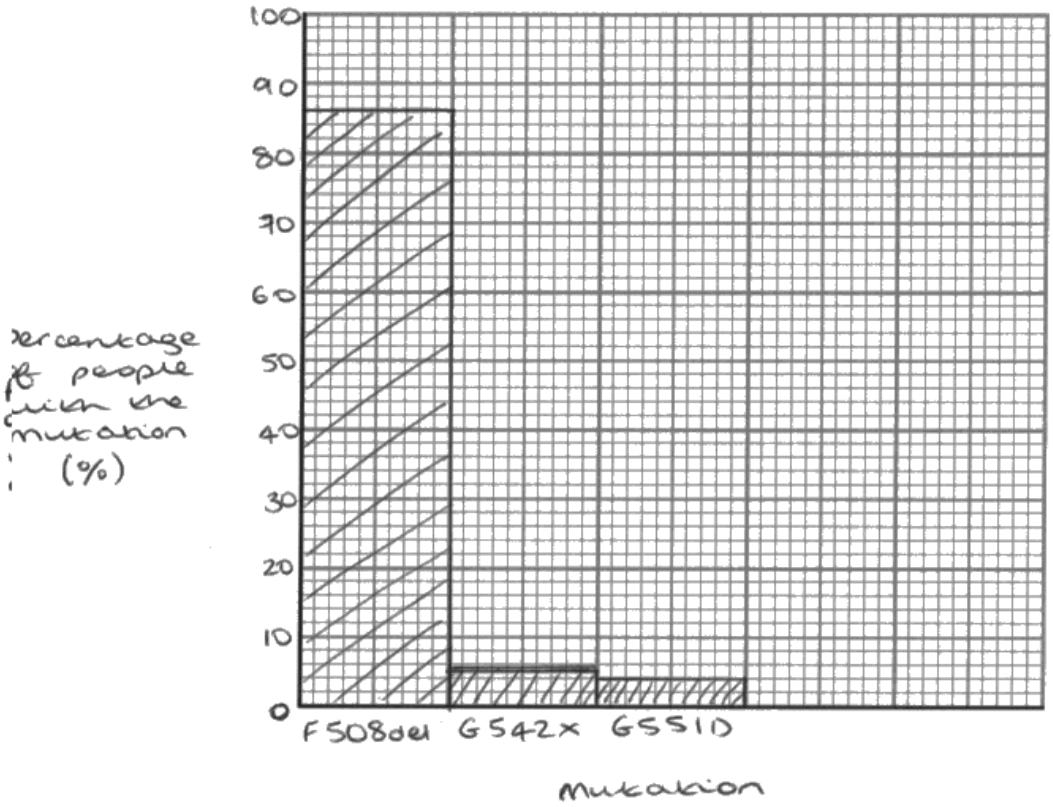
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(1)

(ii) Plot a suitable graph to show the percentage of people with these mutations.

(2)



ResultsPlus
Examiner Comments

This response shows the correct percentages have been calculated and plotted in a suitable graph.

The candidate has used suitable labels and scale for the axes.

(c) In 2013, in the UK, a sample of 10 500 people with cystic fibrosis was studied.

The numbers of people with the three most common mutations of the CFTR gene are shown in the table.

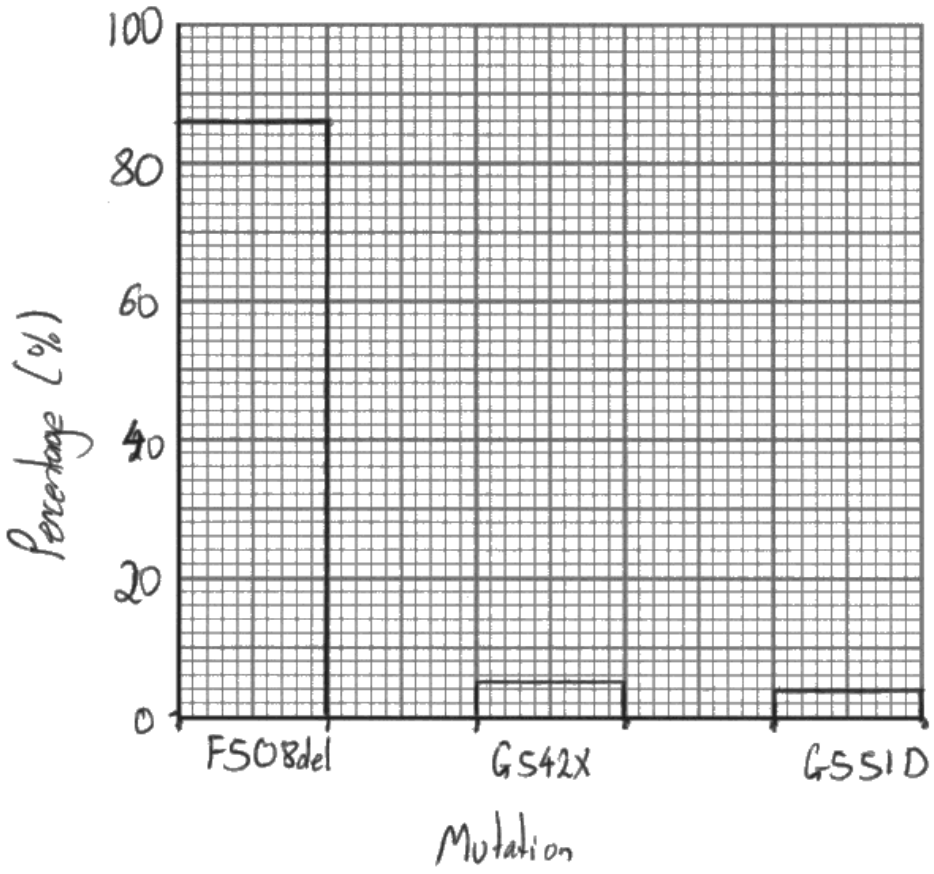
Mutation	Number of people with the mutation	Percentage of people with the mutation (%)
F508del	9030	86
G542X	525	5
G551D	420	4

(i) Complete the table to show the percentage of people with each mutation.

(1)

(ii) Plot a suitable graph to show the percentage of people with these mutations.

(2)



ResultsPlus
Examiner Comments

This candidate did not label the y axis appropriately and therefore gained 2 marks out of 3.

(c) In 2013, in the UK, a sample of 10 500 people with cystic fibrosis was studied.

The numbers of people with the three most common mutations of the CFTR gene are shown in the table.

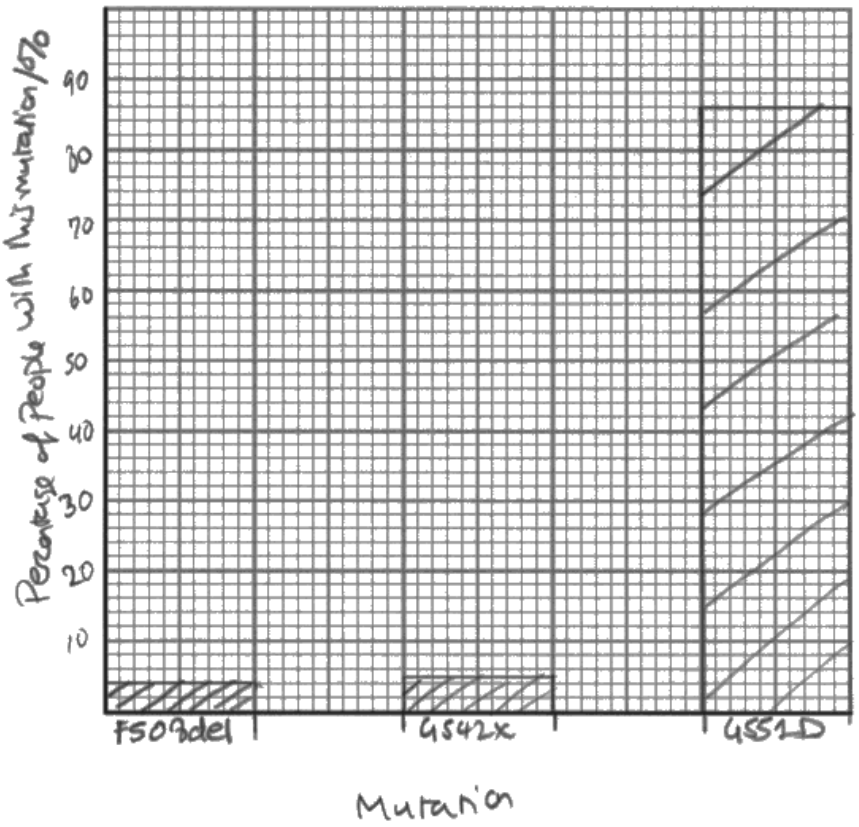
Mutation	Number of people with the mutation	Percentage of people with the mutation (%)
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G551D	420	4

(i) Complete the table to show the percentage of people with each mutation.

(1)

(ii) Plot a suitable graph to show the percentage of people with these mutations.

(2)



ResultsPlus
Examiner Comments

This candidate plotted the information incorrectly and could not gain the third mark.

(c) In 2013, in the UK, a sample of 10 500 people with cystic fibrosis was studied.

The numbers of people with the three most common mutations of the CFTR gene are shown in the table.

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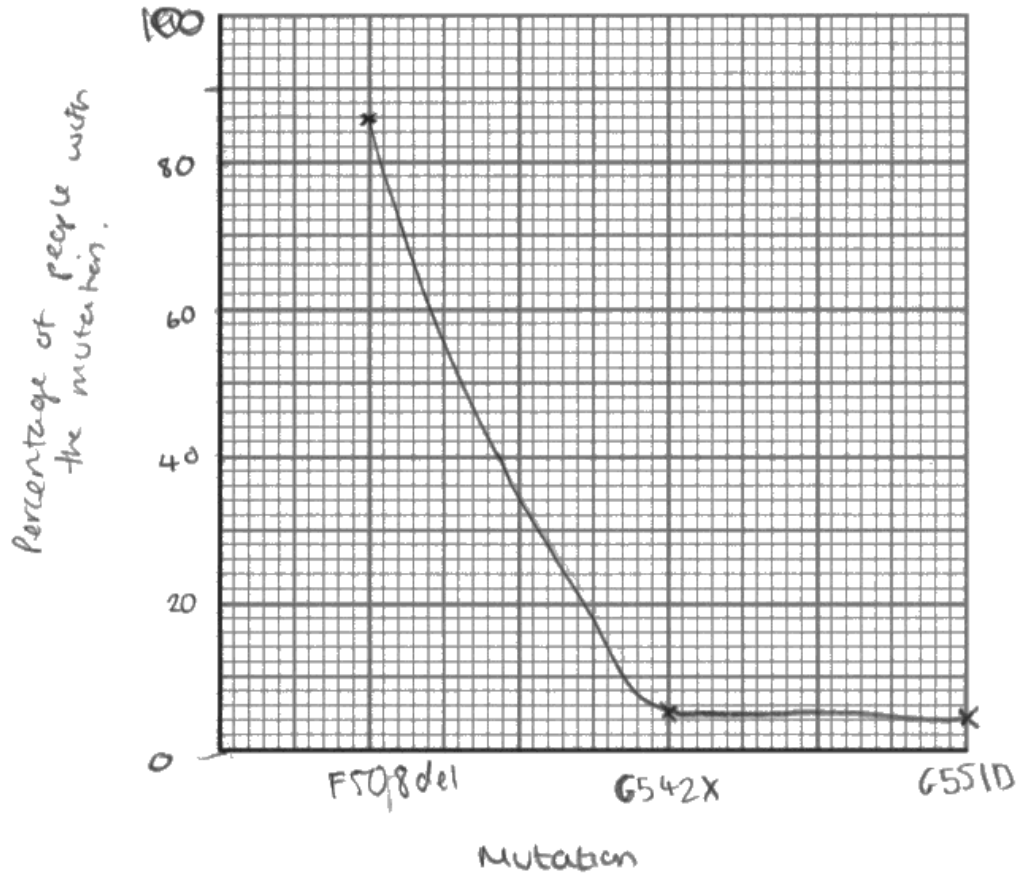
9975

(i) Complete the table to show the percentage of people with each mutation.

(1)

(ii) Plot a suitable graph to show the percentage of people with these mutations.

(2)



ResultsPlus
Examiner Comments

A line graph was not a suitable graph for this type of data.

Question 8 (d)

This question provided the candidates with two pieces of scientific information about three cystic fibrosis mutations. Candidates were expected to analyse and interpret these pieces of data in order to help them answer the question.

Candidates needed to assess the effect that these mutations have on the human respiratory system.

A wide variety of responses were seen.

A small minority of responses did not answer the question asked and instead referred to the effect of cystic fibrosis on the reproductive or digestive systems.

Approximately 30% of responses gained level 1. Here the responses contained some basic knowledge with some attempt to link knowledge and understanding to the given context. For example explaining why cystic fibrosis would result in thicker mucus or increased lung infections. Where there was some reference to the data, this was often limited interpretation. For example a simple statement that all three mutations reduced chloride transport.

Level 2 responses showed evidence of linkages being made. For example linking the reduced quantity of CFTR protein to reduced chloride transport, or relating these mutation to Fick's Law to help explain the effect on the respiratory system.

Very few candidates were awarded a level 3 as most responses did not have evidence of sustained scientific reasoning. Knowledge relating to mutations affecting protein structure and therefore their function were rarely seen which was disappointing.

Assess the effect that these mutations have on the human respiratory system.

(6)

The effect of these mutations is that mucus becomes thicker and stickier. This could affect the human respiratory system because mucus in the trachea or bronchioles is harder to move by the cilia cells due to its stickiness and thickness. This can cause mucus to build up in areas ~~and eventu~~ and cause reductions in air flow through the tubes. This can eventually build up and cause complete blockages in certain airways. This reduces the surface area of gas exchange surfaces in the lungs and results in a lower rate of gas exchange, making it harder for the person to breathe. This can also cause infections in the respiratory system because bacteria caught in the mucus isn't removed from the body and can spread and cause infection in the lungs which may make it harder to breathe.

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Examiner Comments

This response was awarded the lower mark in level 2.

They have described some effects of the CFTR protein problems on the respiratory system, showing some linkages and lines of scientific reasoning with some structure.

However, they could not be awarded the higher mark in the level as they have not included evidence of analysis, interpretation and/or evaluation of both pieces of scientific information.

ResultsPlus
Examiner Tip

If you have been provided with data, then you need to demonstrate that you understand it and can use it to add detail to your answer.

Assess the effect that these mutations have on the human respiratory system.

(6)

The mutation effects the primary structure of the CFTR protein, therefore affecting the type of bonds involved in the polypeptides folding, changing the shape of the protein, making them have reduced function - This is what the G551D and G551S mutations do. The 3 F508del mutation causes completely different proteins to be produced, so there's reduced quantity. As for reduced function, this means that less Cl^- chloride ions (Cl^-) will diffuse out of the cell into the mucus in the lungs, more Sodium ions (Na^+) will move into the cell, following Cl^- ions, decreasing the water potential in the cell. water will move out the mucus in the lungs, into the cell, making the mucus more sticky and viscous. This can begin to block bronchioles or narrow them. at least This decreases the number of alveoli available for gas exchange and so, this, decreases the total surface area available for gas exchange.

Ficks' Law states that rate of gas exchange is proportionate to concentration gradient and surface area, but inversely proportionate to diffusion distance. There reducing total surface area reduces rate of gas exchange.

Also, the blockages can cause over inflation of lungs, damaging lungs and reducing elasticity of lungs. The ciliated cells lining the lungs will be more oxygen, so the concentration gradient in the lungs also decreases, meaning less efficient gas exchange. If the mucus lines the alveoli, then diffusion distance will also increase, so leading to even lower rates of gas exchange.

ResultsPlus
Examiner Comments

This is an example of a level 3 response as there is evidence of sustained scientific reasoning.

The candidate has recognised that the mutated alleles would result in a different tertiary structure and has started to link this knowledge to their analysis and evaluation of both pieces of scientific information.

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 take into account the command words as well as the context given. Answers which do not match the command words or do not relate to the given context will not gain high marks.

- Read your answers back carefully - do they answer the question? Have you made as many clear points as marks are available? Have you explained each point if applicable? Have you used all information you have been provided with - both qualitative and quantitative?

- 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.

- Study the mathematical skills which could be tested and make sure you include your working with all calculations. Give relevant units where applicable.

- When describing the measurement or control of variables, be specific about what is to be measured e.g. volume or mass, and how it is to be measured.

- When asked to compare and contrast, make sure you have included similarities and differences in your comparative statements.

Grade Boundaries

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

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