

Examiners' Report  
January 2012

GCE Biology 6BI01 01

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## Introduction

It was good to see how well many candidates could recall several areas of the specification in a good level of detail. For example a good percentage of candidates scored the maximum of four marks available for question 4a (glycogen structure and function) and an even better percentage of candidates scored all four marks available for question 7a (atherosclerosis). Unfortunately, some candidates struggled with several of the How Science Works questions. Some candidates also let themselves down by not reading the questions carefully enough.

The two sets of multiple choice questions scored very highly.

Question:	Percentage of correct responses:
3ai	91.8
3aia	93.2
3aiii	51.8
8bi	90.6
8bia	93.8
8biia	98.4
8biv	89.1

These scores demonstrate that the vast majority of candidates cope well with recall of knowledge and straightforward data interpretation.

## Question 1 (a)

This was a straightforward cloze question about protein structure to start the paper. Over half of the candidates scored all five marks available. The most common error was to name the bond in proteins as a glycosidic bond rather than a peptide bond.

Answer ALL questions.

Some questions must be answered with a cross . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

1 Proteins, such as enzymes, are important molecules found in all living organisms.

(a) Read through the following passage on the primary structure of proteins, then write on the dotted lines the most appropriate word or words to complete the passage.

(5)

Proteins are made of monomers called amino acids. These monomers are joined together by peptide bonds, formed during condensation reactions.

Each monomer of a protein consists of a central carbon atom attached to a hydrogen atom, an R group, an amino group and a carboxylic group. The sequence of monomers determines the primary structure of the protein.



**ResultsPlus**  
Examiner Comments

This is a typical answer that scores all five marks available.

This candidate's answer only scores two of the available five marks.

**Answer ALL questions.**

**Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.**

1 Proteins, such as enzymes, are important molecules found in all living organisms.

(a) Read through the following passage on the primary structure of proteins, then write on the dotted lines the most appropriate word or words to complete the passage. (5)

Proteins are made of monomers called amino acids. These monomers are joined together by glycosidic bonds, formed during Condensation reactions.

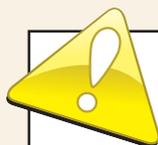
Each monomer of a protein consists of a central carbon atom attached to a hydrogen atom, an R group, an anine group and a phosphate group. The sequence of monomers determines the primary structure of the protein.



**ResultsPlus**  
Examiner Comments

Many candidates made the mistake of naming the bond as glycosidic instead of peptide, mixing up their carbohydrate and protein structures. Similarly they have also thrown in some knowledge about nucleic acid structure with reference to phosphate groups.

Candidates should also take care with spelling. We will accept phonetic spelling of words (unless it is a question designed to assess quality of written communication) but words with clear errors that are non-phonetic will not be allowed. 'Anine' here is an example of something not acceptable, particularly as they have correctly identified the monomers as amino acids.



**ResultsPlus**  
Examiner Tip

Candidates should be careful when recalling specific structural terminology. It is always good to check if the names of parts and groups make sense based on the name of the molecule involved.

## Question 1 (b) (i)

This question asked specifically about the tertiary structure of enzymes. Many candidates answered the question well, but a significant number wrote about primary and secondary structures and proteins in general, for example by describing how they could be fibrous or globular.

The most common marks picked up were for naming some of the bonds involved in the tertiary structure, but many candidates did not refer to these bonds being between R groups. Many candidates did not mention the significance of the shape of the active site, or even mention an active site.

This is a typical example of a response that scored all three marks available.

(b) (i) Describe the three-dimensional (tertiary) structure of an enzyme. (3)

Enzymes are proteins.

The tertiary structure of an enzyme is determined by the amino acid sequence <sup>(in the polypeptide chain)</sup> of the primary structure. (The bonds that form between these when they start to fold more in the tertiary structure determine the 3D shape - these bonds include ionic, disulfide and hydrogen bonds, e.g. lots of cysteine amino acids will mean many disulfide bonds form.) Enzymes have an active site which is what attaches to the substrate, and this active site is what gives enzymes their high specificity. The rest of the enzyme is the supporting structure.

Enzymes are globular proteins; they are soluble, roughly 'round' in shape.



**ResultsPlus**  
Examiner Comments

This response scores marks for recognising specific bonds in the tertiary structure, the presence of an active site and that they are globular proteins.

This is a typical response that only scored one of the three marks available.

(b) (i) Describe the three-dimensional (tertiary) structure of an enzyme.

(3)

A tertiary structure of an enzyme is when the polypeptide chains have formed bonds to create a 3D structure. The 3D structure is held together by ionic bonds, hydrogen bonds, disulphide bonds and Van der Waals forces. This creates a 3D structure which is substrate specific eg. an enzyme.



One mark awarded for naming bonds.

This response scored two of the three marks available.

(b) (i) Describe the three-dimensional (tertiary) structure of an enzyme.

(3)

The tertiary structure of an enzyme can be globular or fibrous. Globular proteins are round and compact. They are ~~the~~ soluble as hydrophilic molecules remain on the outside while hydrophobic molecules clump together on the inside. Fibrous proteins are straight, helical chains so they are strong. ~~They~~ The tertiary structure of proteins has disulfide bonds (between 2 sulfurs), ionic bonds (between charged parts), hydrophilic and hydrophobic interactions and H-bonds (between R groups). The tertiary structure ~~depends on~~ ~~the primary structure~~ makes the ~~pro~~ enzyme very specific due to its bonds and the way it interacts.



### ResultsPlus Examiner Comments

This candidate correctly names some bonds in the tertiary structure and recognises that they are bonds between R groups. However, they do not mention an active site and they do not get the mark for recognising that enzymes are globular proteins because they say that they could be globular or fibrous.



### ResultsPlus Examiner Tip

Read the context of the question carefully to make sure you include relevant details. In this example write about enzymes and not just proteins in general.

## Question 1 (b) (ii)

This question asked candidates to explain how the primary structure of an enzyme determines its tertiary structure and properties.

Some candidates gave very good responses explaining how the sequence of amino acids (the primary structure) determined the position and type of bonds in the tertiary (and secondary) structure which determined the shape of the active site and the way it could interact with specific substrates to catalyse the reaction. Many also explained the significance of hydrophilic and hydrophobic groups in determining the shape of the enzyme and the way it could interact in an aqueous environment.

Unfortunately, some candidates repeated their descriptions from 1b (i) and ignored the enzymes context, and the request to explain its properties.

This is a typical example of a response that did not score any marks.

(ii) Explain how the primary structure of an enzyme determines its three-dimensional (tertiary) structure and its properties.

(3)

The primary structure is very basic and just a long chain of amino acids. Its primary stage determines its tertiary stage by the length of the amino acid chain, the longer it is the more it will coil later on.



**ResultsPlus**  
Examiner Comments

This candidate does not relate their answer to enzymes and does not successfully explain how the primary structure determines the tertiary structure.

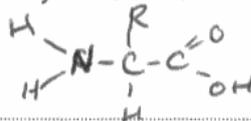


**ResultsPlus**  
Examiner Tip

Make sure your answers relate to the context of the question - in this case the structure and properties of an enzyme.

This is an example of a response that scored no marks.

(ii) Explain how the primary structure of an enzyme determines its three-dimensional (tertiary) structure and its properties. (3)



The amino acids join together by condensation reactions (forming a dipeptide or a polypeptide chain + H<sub>2</sub>O). The length of this chain depends on the number of ~~the~~ amino acids in the chain.



**ResultsPlus**

**Examiner Comments**

Several candidates interpreted this question as asking how the polypeptide chain is formed.



**ResultsPlus**

**Examiner Tip**

Make sure you read the question carefully and answer the question asked, rather than answering the question you hoped that we asked.

This is also an example of a response that scored all three marks.

(ii) Explain how the primary structure of an enzyme determines its three-dimensional (tertiary) structure and its properties.

(3)

the primary structure is the basic sequence of amino acids in a polypeptide chain. The structure of the R-Group determines how the chain is folded. The hydrophobic R-Groups point inwards and are protected by the hydrophilic side-chains. This makes the enzyme soluble ~~with~~ <sup>which</sup> is useful as ~~it~~ <sup>enzymes</sup> speeds up metabolic reactions. The chain of amino acids also decide the depression on the enzyme called an active sight <sup>(Total for Question 1 = 11 marks)</sup> which is specific for a certain substrate.



**ResultsPlus**  
Examiner Comments

This response explains what the primary structure of the enzyme is and how it determines the shape. They also explain how the hydrophobic and hydrophilic groups determine folding and solubility of the enzyme.

Please note 'active sight' was deemed acceptable in this case as it is phonetically correct and clearly in the correct context.

This is a good example of a response scoring all three marks available.

(ii) Explain how the primary structure of an enzyme determines its three-dimensional (tertiary) structure and its properties.

(3)

The primary structure of an enzyme is a polypeptide chain, and the order of the amino acids making this up determines its structure as they determine how it folds up to form the 3D structure. Bonds form between the R groups of the amino acid e.g. they were in a different order they would form in different places. As the polypeptide chain determines the shape of the protein, it also determines which amino acids will be involved in the active sites - so it determines which R-groups the substrate molecules will form bonds with - allowing them to be held in position. It also determines which amino acids will be on the inside and outside - affecting the solubility of the enzyme.

(Total for Question 1 = 11 marks)



**ResultsPlus**  
Examiner Comments

This candidate recognises what the primary structure explains how it determines the bonding and shape of the enzyme, including the active site, and how it interacts with the substrate.



**ResultsPlus**  
Examiner Tip

This is a very good response, covering more than is needed for the three marks available. If it was to be improved it would have been useful to explain how amino acids would be positioned inside or outside the enzyme and how they would affect the solubility.

This is typical of the type of response that frequently only scored one mark.

(ii) Explain how the primary structure of an enzyme determines its three-dimensional (tertiary) structure and its properties.

(3)

Primary structure is a specific sequence of amino acids. If the sequence is changed then the tertiary structure is changed. It is a long chain of peptide bonds.



**ResultsPlus**  
Examiner Comments

Many candidates only described what the primary structure is and failed to go on to explain how it determined the tertiary structure and properties of an enzyme.

## **Question 2 (a)**

This question was designed to test the candidates' understanding of gas exchange in a different context to the lungs, and the circulation system in a mammal. Candidates were directed to use the information in the photograph to inform their answer. They were also informed that the amoeba is a single-celled organism.

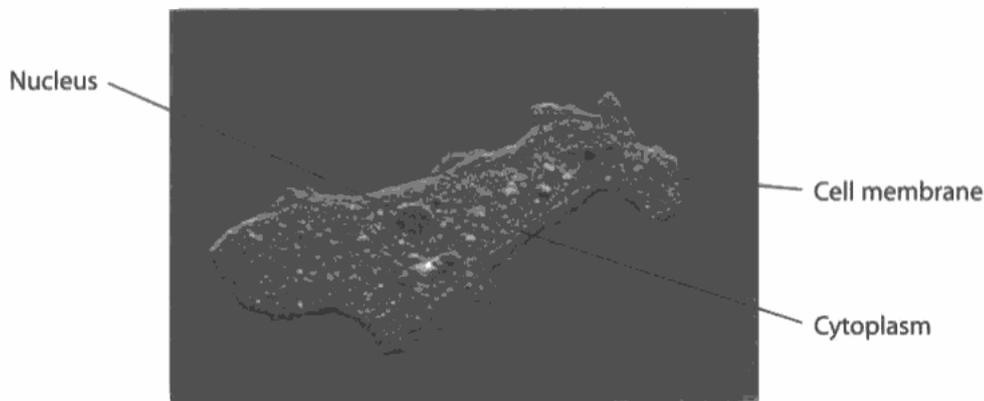
Many candidates scored highly on this question, recognising that gas exchange takes place by diffusion across the cell membrane, involving oxygen and carbon dioxide moving from an area of high concentration to an area of lower concentration.

Unfortunately, several candidates ignored the context and described gas exchange with blood. Others described other transport processes, most commonly osmosis.

This is a typical response scoring all four available marks.

- 2 An amoeba is a single-celled organism that lives in water. Gas exchange in an amoeba occurs between the water and the cytoplasm.

The photograph below shows an amoeba, as seen using a microscope.



Magnification x800

Dr Jeremy Burgess / Science Photo Library

- \*(a) Using the information shown in the photograph and your own knowledge, suggest how gas exchange occurs in an amoeba.

(4)

Gas exchange happens by diffusion, where molecules move from an area of high concentration to low concentration until equilibrium is reached. In the ~~amoeba~~ amoeba, small molecules such as oxygen and carbon dioxide, are able to force their way through the ~~gaps~~ gaps in the phospholipid bilayer. In polar molecules or ~~charged ions~~ ions, gas exchange happens through channel or carrier proteins situated in the membrane. In the amoeba, oxygen will diffuse out of the ~~cell~~ water and into the cell through the cell membrane (phospholipid bilayer) and carbon dioxide will diffuse out of the cell into the water. Both oxygen and carbon dioxide move down their respective concentration gradients and the process is passive. The oxygen can then be used in cell processes.



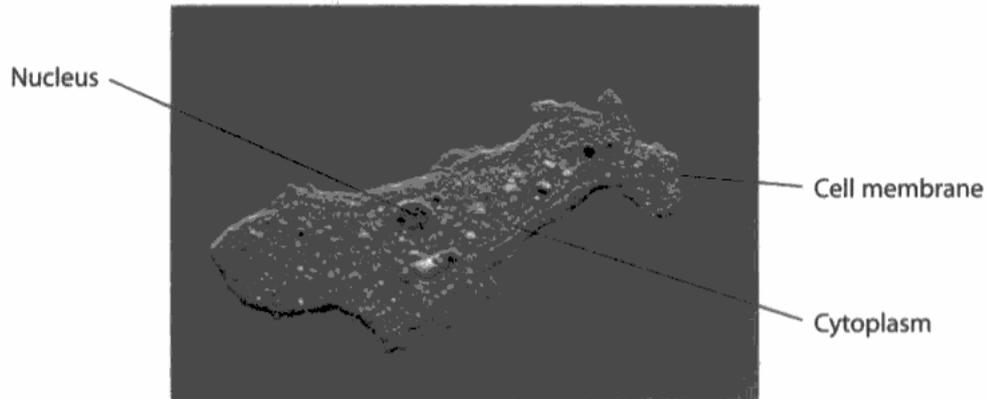
**ResultsPlus**  
Examiner Comments

This candidate successfully identifies where and how diffusion takes place. They also describe the direction the relevant gases will diffuse, also recognising that oxygen and carbon dioxide are small molecules.

This response managed to score three of the four available marks, but also shows some typical mistakes.

2 An amoeba is a single-celled organism that lives in water. Gas exchange in an amoeba occurs between the water and the cytoplasm.

The photograph below shows an amoeba, as seen using a microscope.



Magnification x800

Dr Jeremy Burgess / Science Photo Library

\*(a) Using the information shown in the photograph and your own knowledge, suggest how gas exchange occurs in an amoeba.

(4)

The amoeba has an open circulatory system. The oxygen and other particles may diffuse through the cell membrane into the cytoplasm <sup>by osmosis. This</sup> is where molecules move from an area of high concentration to an area of low concentration. As the amoeba is a single-celled organism it has a thin cell membrane which diffusion can easily happen through a partially permeable membrane.



**ResultsPlus**  
Examiner Comments

This response gains credit for recognising the direction oxygen moves, the involvement of the cell membrane and the concentration gradient. However, they name osmosis as the transport process and describe an open circulatory system for the amoeba.



**ResultsPlus**  
Examiner Tip

Just because an aqueous environment is described, osmosis is not the only transport process possible.

## Question 2 (b)

The first part of question 2 asked specifically about gas exchange in the organism. This part of the question asked candidates to describe how oxygen moves from the cell membrane to the centre of the cell.

Many candidates readily recognised that the transport process involved was diffusion and that it was taking place in the cytoplasm from an area of a high concentration to an area of low concentration.

However, many candidates described transport across the membrane rather than within the cell, and many described alternative transport processes (often endocytosis or active transport).

This is an example of a response scoring both marks available.

(b) Suggest how oxygen passes from the cell membrane into the centre of an amoeba. (2)

Oxygen is a small ~~molecule~~ atom that will move by diffusion throughout the cytoplasm of the amoeba from areas of high concentration to areas of low concentration until it is evenly distributed as oxygen moves about randomly



**ResultsPlus**  
Examiner Comments

Credit can be given to this response for recognising that diffusion is taking place in the cytoplasm. They would also get credit for describing the concentration gradient if it was needed.

This response is typical of those scoring no marks.

(b) Suggest how oxygen passes from the cell membrane into the centre of an amoeba.

(2)

it goes through the cell membrane through osmosis into the amoeba.



**ResultsPlus**  
Examiner Comments

Both the location and process are wrong for the question asked. Both of these mistakes occurred quite frequently.



**ResultsPlus**  
Examiner Tip

Read the question carefully and think about the location asked and what molecule is being moved.

### Question 3 (b)

This question asked candidates to use the information from a table to describe the effect of temperature on permeability.

Most candidates spotted the overall trend, but only a few candidates described where significant changes in permeability were shown (or didn't change) to receive the second mark.

Some candidates did not answer the question asked (describe the effect on permeability) and lost marks by limiting their answer to describing the colour changes alone.

This response scores one of the two marks available.

(b) A student carried out an experiment to investigate the effect of temperature on the permeability of beetroot membranes. Beetroots are root vegetables that appear red because the vacuoles in their cells contain a water-soluble red pigment. This pigment cannot pass through membranes.

Six cubes of beetroot were cut. One piece of beetroot was placed into a tube containing 10 cm<sup>3</sup> of water and left for 20 minutes at 5 °C. After the 20 minutes, each piece of beetroot was removed from the tubes and the colour of the fluid recorded.

The procedure was repeated at five other temperatures.

The results of this experiment are shown in the table below.

Temperature / °C	Colour of fluid
5	pale pink
22	pale pink
42	pale pink
64	pink
87	dark pink
93	red

Using the information in the table, describe the effect that temperature has on the permeability of the membranes of the beetroot cells.

(2)

As the temperature increases the colour of the fluid gradually becomes darker. For the temperatures 5°C, 22°C and 42°C the colour of the fluid stayed the same.



**ResultsPlus**  
Examiner Comments

This candidate has identified that the colour does not change between 5°C and 42°C. However, they have not answered the question asked about the effect of temperature on permeability.



**ResultsPlus**  
Examiner Tip

Read the question carefully and make sure your answer addresses the question asked.

This is a good example of a response that scored both marks available.

(b) A student carried out an experiment to investigate the effect of temperature on the permeability of beetroot membranes. Beetroots are root vegetables that appear red because the vacuoles in their cells contain a water-soluble red pigment. This pigment cannot pass through membranes.

Six cubes of beetroot were cut. One piece of beetroot was placed into a tube containing 10 cm<sup>3</sup> of water and left for 20 minutes at 5 °C. After the 20 minutes, each piece of beetroot was removed from the tubes and the colour of the fluid recorded.

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22	pale pink
42	pale pink
64	pink
87	dark pink
93	red

Using the information in the table, describe the effect that temperature has on the permeability of the membranes of the beetroot cells.

(2)

*As temperature increases, permeability will also increase, after temperatures of 42°.*



### ResultsPlus Examiner Comments

This response clearly, and concisely, identifies the correct trend and identifies when the permeability change is occurring.



### ResultsPlus Examiner Tip

When a 'describe' question is allocated two or more marks you will need to include more than just an overall trend.

This is a typical response that scored only one of the two marks available.

There is a positive correlation between the temperature of the water and the permeability of the cell membrane, as the amount of pigment leaking out has increased, suggesting the membranes have been broken down. This is because the temperature increase causes an increase in the kinetic energy of the phospholipids, causing them to vibrate more and break apart releasing the contents of the vacuole.



**ResultsPlus**  
Examiner Comments

This candidate described the overall trend correctly, but rather than looking at the data more closely, they wasted time explaining the data rather than describing it.



**ResultsPlus**  
Examiner Tip

Make sure candidates understand the difference between 'describe' and 'explain'.

This response did not score any marks.

(b) A student carried out an experiment to investigate the effect of temperature on the permeability of beetroot membranes. Beetroots are root vegetables that appear red because the vacuoles in their cells contain a water-soluble red pigment. This pigment cannot pass through membranes.

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Temperature / °C	Colour of fluid
5	pale pink
22	pale pink
42	pale pink
64	pink
87	dark pink
93	red

Using the information in the table, describe the effect that temperature has on the permeability of the membranes of the beetroot cells.

(2)

An increase in temperature, decreases the permeability of the membrane ~~but~~ as more pigment has leaked out of the cell by osmosis as the temperature has risen.



**ResultsPlus**  
Examiner Comments

This response demonstrates two frequent errors. The trend is the wrong direction and they link the movement of pigment to osmosis.



**ResultsPlus**  
Examiner Tip

Candidates should be reminded what is meant by the terms permeability and osmosis.

### Question 3 (c) (i)

The majority of candidates easily identified two clear control variables.

The most common mistake was to use a vague term, such as amount, rather than something that can clearly be controlled like volume or mass.

This is a typical response that scores both marks available.

(c) A second student carried out a very similar experiment, using three samples of beetroot at each temperature. She used a colorimeter to determine the intensity of the colour of the fluid produced.

The results of her experiment are shown in the table below.

Temperature / °C	Intensity of colour of fluid / arbitrary units		
	Sample 1	Sample 2	Sample 3
5	0.0	0.0	0.0
22	10.1	9.8	11.1
42	26.3	29.9	31.0
64	80.1	77.0	76.9
87	93.9	95.0	96.0
93	100.0	100.0	100.0

(i) State **two** variables that both of these students must keep the same if their results are to be compared.

(2)

1. Have the same volume of water (10cm<sup>3</sup>)

2. keep the <sup>beetroot</sup> beetroot in the water for the same time (20 minutes)



**ResultsPlus**  
Examiner Comments

Although this is not needed, specifying values (and units) for the control variables adds further clarity to this response.

This response scores one mark.

- 1 Beetroot size/mass
- 2 the amount of water.



**ResultsPlus**

**Examiner Comments**

One mark is allowed for beetroot size/mass. However 'amount of water' is too vague for credit.



**ResultsPlus**

**Examiner Tip**

Avoid using the term amount. State a specific measurement that can be made/controlled e.g. mass, surface area, etc.

### Question 3 (c) (ii)

The majority of candidates were able to identify two clear reasons for the second set of results being more reliable than the first set.

This is a good example of a response that scored both available marks.

(ii) Give **two** reasons why the results obtained by the second student are more reliable than those of the first student. (2)

1 The colourimeter measures to ~~be~~ a higher degree of accuracy than observations  
the students - the results of the 2nd student are quantitative not qualitative

2 The second student has repeated her results for the different temperatures three times - so anomalies are more obvious and they are more reliable and an average can be calculated.



#### ResultsPlus Examiner Comments

One mark is awarded for the comment on accuracy and quantitative measurements. The second mark is awarded here for repeating results.



#### ResultsPlus Examiner Tip

Reliability is down to the repeatability and reproducibility of the data. Repeating measurements and making objective quantifiable measurements are more likely to be more reliable than subjective judgements and observations.

When making a comparison make sure it is clear which set of data is being referred to in your answer.

### Question 3 (c) (iii)

Many candidates demonstrated an understanding of the core practical and recognised that the colour was due to pigment released when the cells had been damaged. They recognised that the pieces of beetroot may not have been rinsed as thoroughly.

Some candidates who failed to score on this question thought that the colorimeter was less sensitive than the human eye so therefore could not pick up on the colour. Others thought that it could be down to other uncontrolled variables such as the size of the beetroot or the volume of the water. These may change the intensity of colour, but would not affect whether the membrane was permeable or not.

This response scored no marks.

(iii) In the first student's experiment at 5 °C, the fluid was pale pink but the fluid in the second student's experiment was colourless.

Suggest an explanation for this difference.

(2)

*This may be because the colorimeter was not able to detect colour to that low an amount.*



**ResultsPlus**  
Examiner Comments

This is an example of a common mistake where the candidates think that the colorimeter is not sensitive enough.

This response scored both marks available.

(iii) In the first student's experiment at 5 °C, the fluid was pale pink but the fluid in the second student's experiment was colourless.

Suggest an explanation for this difference. (2)

If the first student didn't thoroughly rinse his beetroot, there may have still been some pigment left due to preparation - it will have been released when the beetroot was cut up. If the 2nd student rinsed hers, it would give a colourless solution.



**ResultsPlus**  
Examiner Comments

This candidate has scored marks for recognising that the colour in the first experiment could be due to lack of rinsing and the pigment.



**ResultsPlus**  
Examiner Tip

Although this answer scored full marks, it would have been better if they had stated what was damaged and where the pigment was being released from as a result of the beetroot being cut.

This response scored no marks.

(iii) In the first student's experiment at 5 °C, the fluid was pale pink but the fluid in the second student's experiment was colourless.

Suggest an explanation for this difference. (2)

first student kept the beetroot in the water for a longer period of time, than the second student



**ResultsPlus**  
Examiner Comments

This is a typical example of a candidate identifying a variable that would affect intensity of colour, but not whether colour would be present or not.

### Question 3 (c) (iv)

There were a wide range of responses acceptable for this question, asking candidates to suggest ways in which the descriptions of the data may differ. These centred around either the numerical nature of the data for set 2, or the different descriptions of the effect on permeability at different temperatures.

This is an example of a response that did not score any marks.

(iv) Each of the students used their own results to describe the effect of temperature on the permeability of the membranes of the beetroot cells. <sup>the</sup> beetroot.

Suggest **one** way in which these two descriptions might differ. (1)

The second student may have more accurate results as she did repeats and therefore could find anomalies.

(Total for Question 3 = 12 marks)



#### ResultsPlus Examiner Comments

This candidate has compared the quality of the data (essentially asked in the previous parts of the question) and ignored the instruction to compare the descriptions of the effect of temperature on the permeability of the membranes.



#### ResultsPlus Examiner Tip

Another example of where it is important to read the question carefully.

This response scores one mark.

(iv) Each of the students used their own results to describe the effect of temperature on the permeability of the membranes of the beetroot cells.

Suggest **one** way in which these two descriptions might differ.

(1)

The second student's results will be more accurate because they will have figures and numbers to compare rather than just differences in (Total for Question 3 = 12 marks)

colour. They will be able to compare the effects of each temperature on the cell membrane, because they repeated the experiment and so ~~the~~ he will be able to account for any anomalies.



### ResultsPlus Examiner Comments

This is an example of a response that focuses on the differences between the numerical nature of the two descriptions possible.

This response also gains the mark available.

(iv) Each of the students used their own results to describe the effect of temperature on the permeability of the membranes of the beetroot cells.

Suggest **one** way in which these two descriptions might differ.

(1)

The 2nd student's description will say ~~if~~ permeability increases with every increase in temp. Whilst 1st student may say the permeability only ~~decreases~~ increases ~~at~~ above 42° (at 64°) (Total for Question 3 = 12 marks)



### ResultsPlus Examiner Comments

This response is an example of the other common way of comparing the descriptions - comparing the descriptions of permeability at different temperatures.

## Question 4 (a)

A large number of candidates had a sound knowledge of the structure and function of glycogen. The most common correct points identified by candidates were that: glycogen contains glycosidic bonds, is branched, compact, insoluble and easily hydrolysed.

It was surprising that more candidates did not mention that glycogen is made of glucose.

Some candidates mistakenly think that glycogen is made from amylose and amylopectin. Some other candidates confused glycogen with a triglyceride or glucose and described (and drew) a glucose molecule as their answer to this question.

There were a lot of candidates who thought that the structure made it hard to break down and it was therefore suitable for slow release of energy over a long period of time, rather than recognising that the branched structure enables rapid hydrolysis for release of glucose quickly when needed.

This response scores all four marks available.

4 Fats and carbohydrates such as glycogen are important energy storage molecules. These are broken down during exercise.

(a) Describe the structure of glycogen and explain why it is a suitable molecule for storing energy.

(4)

Glycogen is a polymer made from glucose molecules joined together by glycosidic bonds. ~~Bonds form between the 1,4 and~~ 1,6 glycosidic bonds form, so glycogen has a branched structure. Glycogen is compact, so a large amount of glucose can be ~~be~~ stored in a small space. Also it is insoluble, so it doesn't affect the osmotic balance of a cell.



**ResultsPlus**  
Examiner Comments

This candidate has managed to recognise most structural features of glycogen and explained why it is a suitable molecule for storing energy.



**ResultsPlus**  
Examiner Tip

The main omission in this response is that glycogen can be rapidly hydrolysed - one of the consequences of its branched structure.

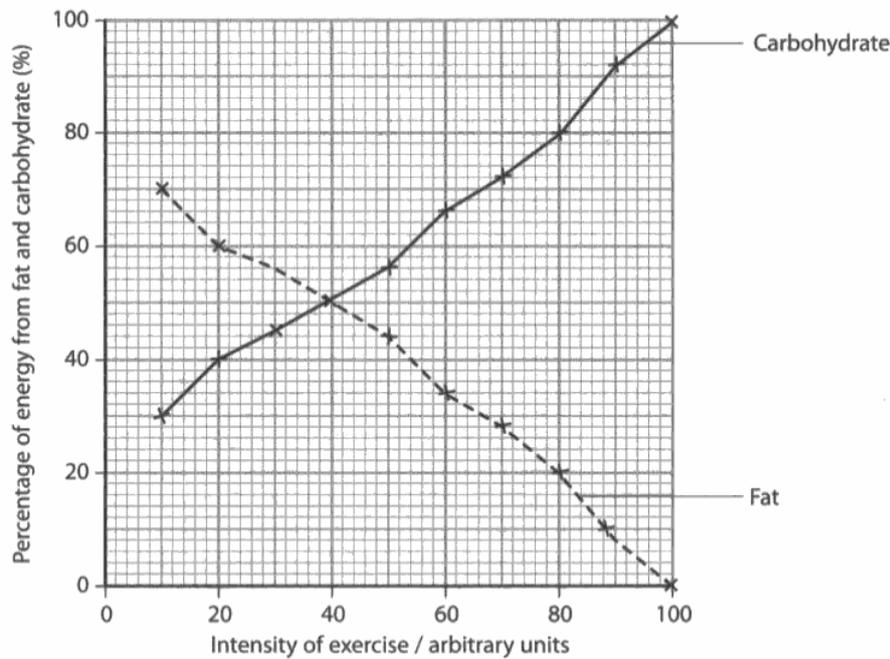
### **Question 4 (b) (i)**

Most candidates scored one or two marks for this three mark question.

The better responses clearly described a correlation to score one mark and a comparison between the use of fat and carbohydrate in relation to intensity level to score a second point. Many candidates managed to point out the equality of use at 39/40 au and pleasingly, there were a good number of correct answers using manipulated data. Too often, however, candidates merely quoted figures and several responses were quite muddled.

This response scores all three marks available.

(b) The graph below shows how the percentage of energy obtained from fat and carbohydrate varies according to the intensity of exercise being carried out.



(i) Using the information in the graph, describe how the source of energy used depends on the intensity of exercise.

(3)

As the intensity of exercise increases, the <sup>percentage</sup> of energy from carbohydrate also increases. As the intensity of exercise increases, the percentage of energy from fat decreases. At 10 arbitrary units, ~~fat~~ the percentage of fat burnt is 40% higher than the percentage of carbohydrates burnt. At 40 arbitrary units, the percentage of fat and carbohydrate burnt is the same at 50%. At 100 arbitrary units, 100% of carbohydrate is burnt and <sup>no</sup> fat is burnt. This shows that for less intense exercise, fat is burnt but for more intense exercise, carbohydrate is ~~burnt more likely to be~~ burnt. <sup>a higher % of</sup>



### ResultsPlus Examiner Comments

This candidate has correctly recognised the trends shown by the graph, recognised the cross-over point and has completed some simple manipulation of figures to help illustrate some of their points (recognising that fat is 40% higher than carbohydrate at 10 arbitrary units).



### ResultsPlus Examiner Tip

When describing a graph, compare figures using a simple calculation, like this candidate, and don't just quote figures. Stating fat was at 70% and carbohydrates were 30% at 10 arbitrary units will not get the marks, but recognising that fat is 40% higher does.

## Question 4 (b) (ii)

This question achieved the full range of marks with the vast majority of candidates picking up at least one mark for naming a type of athletic event that can be interpreted as being high intensity. Candidates were not expected to know what respiratory substrates and types of respiration would be carried out during different types of exercise. They were therefore given credit for naming an event that could be interpreted as being high intensity. This included power events such as sprints and endurance events like marathon running. Simply stating that a carbohydrate-loading diet is suitable for high intensity exercise was enough for one mark.

Only the better candidates clearly related their explanations back to evidence from the graph and their knowledge of glycogen structure.

This response scores all three marks available.

- (ii) A carbohydrate-loading diet is used by athletes in preparation for some athletic events. This diet involves increasing carbohydrate intake and decreasing activity, several days before the event.

Carbohydrate-loading is not a suitable method of preparation for all athletic events.

Using the information in the graph and your knowledge of glycogen, explain what type of athletic event could be prepared for using a carbohydrate-loading diet.

(3)

As carbohydrates supply the majority of energy from intensities of just above 40 to ~~100~~ <sup>(above 40)</sup> the athletic event would have to be quite a high intensity for it to be worth the athlete carbo-loading. As carboloading would increase the amount of glycogen in liver + muscles it also suggests the event as well as being quite high intensity ~~was~~ would also be for quite a long duration eg: a ~~long~~ <sup>distance</sup> running event.



**ResultsPlus**

Examiner Comments

This candidate has referred back to the graph and glycogen to explain why the carbohydrate-loading diet will be appropriate for someone preparing for a high intensity event such as a long distance running event.

## Question 5 (a)

This question tested the candidates' understanding of the processes of preimplantation genetic diagnosis and prenatal genetic screening. The key to success for this question was understanding the terms *preimplantation* and *prenatal*.

5 Genetic screening can be used to determine if an embryo has a genetic disorder, such as cystic fibrosis.

- (a) The table below refers to the methods used in preimplantation genetic diagnosis and prenatal genetic screening. If the statement is correct, place a tick (✓) in the appropriate box and if the statement is incorrect, place a cross (✗) in the appropriate box.

(2)

Method of screening	Statement	
	Screening performed during pregnancy	Cells removed from the embryo
Preimplantation genetic diagnosis	✗	✓
Prenatal genetic screening	✓	<del>✓</del> ✗



**ResultsPlus**  
Examiner Comments

This is an example of a response that scored both marks.



**ResultsPlus**  
Examiner Tip

This is a good example of how you can clearly show that you have changed your mind when making a change in a tick or cross response.

This response receives one of the two available marks.

5 Genetic screening can be used to determine if an embryo has a genetic disorder, such as cystic fibrosis.

(a) The table below refers to the methods used in preimplantation genetic diagnosis and prenatal genetic screening.

If the statement is correct, place a tick (✓) in the appropriate box and if the statement is incorrect, place a cross (✗) in the appropriate box.

(2)

Method of screening	Statement	
	Screening performed during pregnancy	Cells removed from the embryo
Preimplantation genetic diagnosis	✗	✗
Prenatal genetic screening	✓	✓



**ResultsPlus**

**Examiner Comments**

Both responses in the first column are correct, but neither of the responses in the second column are worthy of credit. This is an example of where a change to a response is not clear enough, and because it is ambiguous we are not able to award it credit.



**ResultsPlus**

**Examiner Tip**

If you change your mind make it clear by clearly crossing out the entire tick and replacing it with a separate cross.

This response only scored one of the two marks available.

5 Genetic screening can be used to determine if an embryo has a genetic disorder, such as cystic fibrosis.

(a) The table below refers to the methods used in preimplantation genetic diagnosis and prenatal genetic screening.

If the statement is correct, place a tick (✓) in the appropriate box and if the statement is incorrect, place a cross (✗) in the appropriate box.

(2)

Method of screening	Statement	
	Screening performed during pregnancy	Cells removed from the embryo
Preimplantation genetic diagnosis		✓
Prenatal genetic screening	✓	



**ResultsPlus**  
Examiner Comments

Both ticks are correct for one mark, but we can't mark blanks as crosses.



**ResultsPlus**  
Examiner Tip

If you are asked to fill in a table with a tick or a cross in the appropriate box make sure you do not leave blank boxes.

This response scored one of the two marks available.

5 Genetic screening can be used to determine if an embryo has a genetic disorder, such as cystic fibrosis.

(a) The table below refers to the methods used in preimplantation genetic diagnosis and prenatal genetic screening.

If the statement is correct, place a tick (✓) in the appropriate box and if the statement is incorrect, place a cross (✗) in the appropriate box.

(2)

Method of screening	Statement	
	Screening performed during pregnancy	Cells removed from the embryo
Preimplantation genetic diagnosis	✗	✓
Prenatal genetic screening	✓	✓



### ResultsPlus Examiner Comments

This is an example of one of the most common errors where candidates think that prenatal screening involves embryos rather than a fetus.



### ResultsPlus Examiner Tip

Make sure that you are clear that preimplantation involves cells being removed from an embryo before it is implanted in the uterus; whereas prenatal screening involves the developed fetus during pregnancy and before birth.

### Question 5 (b) (i)

Just over half of the candidates managed to successfully name (not describe) one method of prenatal genetic screening.

This response does not gain any marks.

(b) (i) Name **one** method of prenatal genetic screening.

(1)

Needle in the abdomen to extract embryonic cells.



#### ResultsPlus Examiner Comments

This response contains two mistakes:

1. they are asked to name not describe the process;
2. many candidates think that prenatal screening involves embryos.



#### ResultsPlus Examiner Tip

Make sure you learn the names of processes included in the specification.

(b) (i) Name **one** method of prenatal genetic screening.

(1)

Chronic villus sampling



**ResultsPlus**

**Examiner Comments**

This is a common example of a response that failed to score the available mark because the spelling error makes the first word into something completely different and is not phonetically correct.



**ResultsPlus**

**Examiner Tip**

Chronic instead of **chorionic** is a common error that occurs frequently everytime a question like this has been asked. Make sure you are aware of the danger.

(b) (i) Name **one** method of prenatal genetic screening.

(1)

amniocentesis



**ResultsPlus**

**Examiner Comments**

This was the most common correct response.

### Question 5 (b) (ii)

The majority of candidates managed to score two marks for this question, identifying and discussing an ethical or social issue related to prenatal genetic screening.

The most common correct responses either explored the possible loss of a healthy fetus through miscarriage, or discussion over the issue of abortion as contradicting the 'right to life' of the fetus.

The most common error for candidates was to discuss their answers in the context of an embryo, demonstrating that they had either recalled previous mark schemes or did not understand the context of the question.

This response scores both marks available.

(ii) Discuss either **one** ethical issue or **one** social issue relating to the use of this method of prenatal genetic screening. (2)

~~It is wrong to give women a choice for having~~  
~~also~~ The procedure could cause a miscarriage  
so a potentially healthy baby could be lost,  
this will cause the mother stress and cause her  
to become depressed.



#### ResultsPlus Examiner Comments

This candidate has actually managed to identify an issue and develop two consequences; the loss of the healthy baby and the stress/depression of the mother. Either of these would have been enough for the second mark.

This response scored one of the two marks available.

(ii) Discuss either **one** ethical issue or **one** social issue relating to the use of this method of prenatal genetic screening.

(2)

One ethical issue is that the parents may terminate the embryo if it has the genetic disorder. And this is taking away a potential human life. A social issue ~~is~~ could be that the parents may decide to keep the baby so they can plan financially for the future.



**ResultsPlus**

**Examiner Comments**

This candidate does not receive the mark for taking away the right to life of the embryo because prenatal genetic screening does not involve embryos. However, they have been given credit for the separate point about helping the parents prepare for the future.



**ResultsPlus**

**Examiner Tip**

Make sure you check the context of the question and do not repeat answers from previous exam papers. Prenatal genetic screening involves obtaining cells from the fetus or placenta (not an embryo).

### Question 5 (c) (i)

Most candidates gained a mark for recognising that genetic disorders are caused by faulty alleles. Disappointingly, a very common error was to state that this allele was removed or replaced by the normal allele by gene therapy.

Only the better candidates referred to the correct protein being formed by the cells as a result of gene therapy.

This response scores both marks available.

(c) Gene therapy has the potential to treat some genetic disorders.

(i) Explain why gene therapy has the potential to treat some genetic disorders.

(2)

Genetic disorders are caused by a mutation of the DNA, but gene therapy can use vectors to insert the normal form of the allele into cells, so it can be transcribed and translated.



**ResultsPlus**

**Examiner Comments**

This candidate has recognised that the disorder is caused by a faulty allele and that gene therapy inserts a normal allele into the cells. They would also have gone on to achieve the third marking point available if they had told us what is produced by transcription or translation of the normal allele.

This response scores one of the available two marks.

(c) Gene therapy has the potential to treat some genetic disorders.

(i) Explain why gene therapy has the potential to treat some genetic disorders.

(2)

It replaces the 'faulty' allele, that causes the disorder with the normal allele with the use of a vector to restore functions in the body that the disorder might have caused problems with.



**ResultsPlus**

**Examiner Comments**

This candidate gains a mark for recognising that the genetic disorder is caused by a faulty allele, but they are wrong to state that this allele is replaced by gene therapy, and they go on to start describing how to carry out gene therapy (question 5bii) rather than explaining how gene therapy can treat the disorder.



**ResultsPlus**

**Examiner Tip**

It is very difficult to remove, replace or correct an allele within a cell. Gene therapy is designed to place a 'normal' allele within a cell, in addition to the existing alleles in the genome.

### Question 5 (c) (ii)

This question allowed most candidates to easily gain 2 marks for reference to a vector, and to a suitable delivery mechanism for the vector. A third point was gained by the more able candidates, usually for reference to the introduction of the alleles into cells. It was pleasing to note that some candidates understood the need to repeat the treatment.

Few candidates correctly referred to the site of delivery (eg. the lungs). Only the best candidates correctly identified the use of genes coding for the CFTR protein OR channel.

This response gained all three marks available.

(ii) Suggest how patients with cystic fibrosis could be treated using gene therapy.

(3)

In cystic fibrosis, the normal form of the allele coding for the CFTR protein is inserted into epithelial cells by a vector (a virus or liposomes). The functioning gene is then transcribed and translated, so the functioning form of the protein is produced. Repeated treatment would be needed as epithelial cells die. The virus or liposomes could be in the form of an aerosol which is breathed in.



**ResultsPlus**  
Examiner Comments

This candidate has identified what allele is needed and how to insert it into cells via a vector and aerosol. They have also recognised the need to repeat the treatment because the epithelial cells die. The only significant thing missing from this very good answer is recognition of which organ to target.

### **Question 6 (a) (i)**

Most candidates who answered the question gained marks for recognising that tissue Z has the highest activity, and tissue Y has the lowest activity. Fewer candidates stated that X and Y had similar levels, and some even stated that they had the same levels of activity. There were a few pleasing answers that correctly made the general statement that different tissues have different levels of catalase activity. It was also pleasing to see a good number of candidates scoring a mark for making a correct manipulation of the figures, usually stating the difference in activity between tissue Z and tissue Y, although some candidates failed to read the scale correctly.

It was disappointing to see a significant number of candidates completely misread this question and compare activity in mussels E and M instead of describing the activity of catalase in the tissues of mussel E.

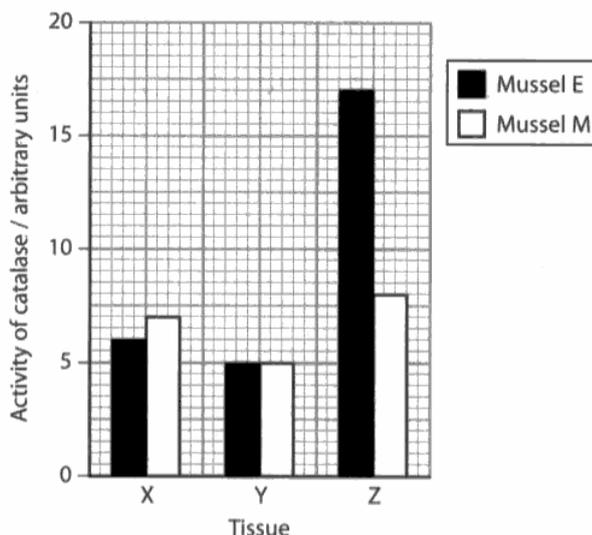
This response scores all three marks available.

6 Catalase is an enzyme present in many tissues of most living organisms. Its role is to break hydrogen peroxide down into oxygen and water. Hydrogen peroxide is produced by cells and is very harmful if it is not broken down.

(a) A study compared the activity of catalase in the tissues of freshwater mussels. Mussels from two different rivers: mussel E from the river Eo and mussel M from the river Masma were studied.

The catalase activity was measured in three tissues, X, Y and Z, taken from each type of mussel.

The graph below shows the results of this study.



(i) Use the information in the graph to state the conclusions that can be made about the activity of catalase in the tissues of mussel E.

(3)

The activity of catalase varies in all the tissues of mussel E; it is lowest in Y (at 5 arbitrary units) and highest in Z (at 17 units), with X being only slightly higher ~~than~~ than Y (at 6 units). It has the most effect on Z - over three times more catalase activity is shown than in Y.



**ResultsPlus**  
Examiner Comments

This candidate has made the general statement that catalase activity varies in all tissues, and that Z is highest and Y is lowest (and close to X).



**ResultsPlus**  
Examiner Tip

This response would not get the manipulation of figures mark because recognising that Z has over three times more activity than Y is too vague. Make sure you bring a calculator into the exam and use it. The increase in activity is 3.4 times, which is over three times (but so are many other numbers e.g. 5).

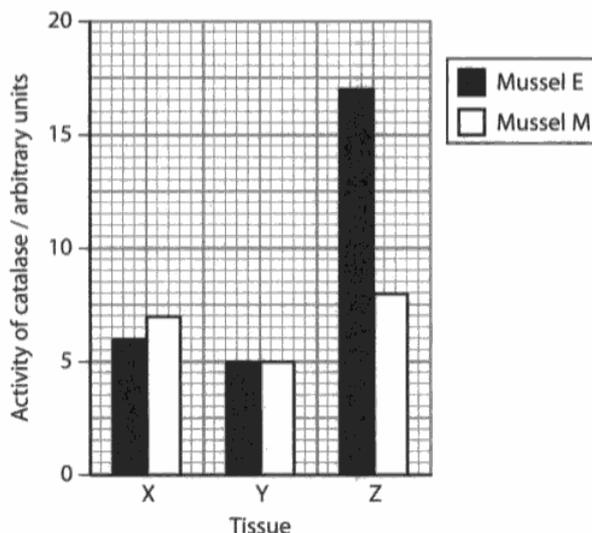
This response failed to score any marks.

6 Catalase is an enzyme present in many tissues of most living organisms. Its role is to break hydrogen peroxide down into oxygen and water. Hydrogen peroxide is produced by cells and is very harmful if it is not broken down.

(a) A study compared the activity of catalase in the tissues of freshwater mussels. Mussels from two different rivers: mussel E from the river Eo and mussel M from the river Masma were studied.

The catalase activity was measured in three tissues, X, Y and Z, taken from each type of mussel.

The graph below shows the results of this study.



(i) Use the information in the graph to state the conclusions that can be made about the activity of catalase in the tissues of mussel E.

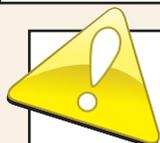
(3)

Catalase is used more in tissue X by Mussel M than mussel E and, in tissue Y, mussel E and M use <sup>Catalase</sup> ~~the same~~ equally to break down hydrogen peroxide. Finally, in tissue Z, mussel E has a much higher activity of catalase than mussel <sup>M</sup> ~~E~~ as it is almost double of it. So mussel E primary



### ResultsPlus Examiner Comments

This response is typical of the many candidates who did not answer the question asked but chose to compare mussel E with mussel M instead. They also lack clarity in some of their statements. For example "almost double" is not clear enough for a manipulation of figures mark, and "mussel E primary activity is in the Z tissue" is not clear enough to be interpreted as stating that tissue Z had the highest activity of catalase in mussel E.



### ResultsPlus Examiner Tip

Read the whole question carefully, in this case you would have spotted that this answer corresponds to the question asked in 6aii.

### Question 6 (a) (ii)

Most candidates managed to identify at least one clear statement directly comparing the activity of mussel E and mussel M in a particular tissue (often all three). Many candidates also gained the manipulation of figures mark for stating the difference between the mussels in tissue X or for tissue Z.

It was pleasing to see some candidates recognising that mussel E has more overall activity. Very few candidates recognised that the order of activity was the same in both mussels.

This response gained both available marks.

(ii) Using the information in the graph, compare the activity of catalase in mussel E and mussel M.

(2)

MUSSEL E and mussel m both have the greatest activity at Z, the next greatest at X and the smallest at Y. Both activities are equal at tissue Y with 5 units but there is a large difference of 9 units between E and M at tissue Z.



**ResultsPlus**  
Examiner Comments

This candidate recognised that the order of activity is the same in both mussels and that activity is the same in tissue Y. They have also calculated the difference between the mussels in tissue Z.

This response scores one of the two available marks.

(ii) Using the information in the graph, compare the activity of catalase in mussel E and mussel M.

(2)

Overall comparing the results from all the tissues the enzyme activity is higher in mussel E than mussel M.



**ResultsPlus**

**Examiner Comments**

This candidate provides a good comparison of the overall activity in the two mussels, but has not gone on to make any other comparisons or calculate how much higher the overall activity is, so only matches one mark point.



**ResultsPlus**

**Examiner Tip**

If a comparison question is worth more than one mark you will need to make more than one statement and/or back up your comparison with some supporting manipulation of figures.

## **Question 6 (b)**

This question achieved a full spread of marks from 0 to 4. Surprisingly only a small amount of candidates managed to score all four available marks, despite this being a straightforward question on experimental design.

The most common correct answer was that candidates recognised the need to repeat measurements for reliability.

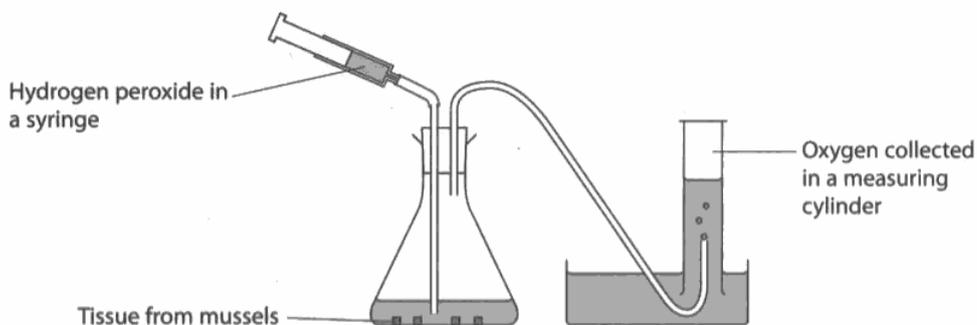
Many candidates lost marks for controlling variables or measuring oxygen produced by using the vague term *amount* instead of specifying something that can be measured e.g. the volume of oxygen produced, the volume of hydrogen peroxide added, the mass of tissue, etc.

The best candidates recognised that to compare activity of the tissues, they would want to measure the initial rate of reaction.

This response scored one of the four marks available.

(b) Catalase activity in tissue from mussels can be studied using the apparatus shown below.

Tissue from mussels is placed in the flask and hydrogen peroxide is added using the syringe. The oxygen produced from the breakdown of hydrogen peroxide is collected in the measuring cylinder.



Describe how this apparatus could be used to compare the catalase activity in two different types of mussel.

Both mussels would be placed in <sup>separate</sup> ~~the~~ flasks and the same amount of hydrogen peroxide would be added. The change in oxygen collected for each ~~made~~ tissue from the mussels would be recorded. The tissue with the greatest change would be the one with the highest activity of catalases. The same size pieces of tissue would have to be used under the same conditions, for example at room temperature. (4)



### ResultsPlus Examiner Comments

Many of the variables stated in this example are too vague for credit e.g 'change in oxygen collected' should be 'volume of oxygen' or 'number of bubbles counted'; same amount of hydrogen peroxide; room temperature.

There is also no reference to time or repeats.

They did however get credit for reference to using the same size pieces of tissue.



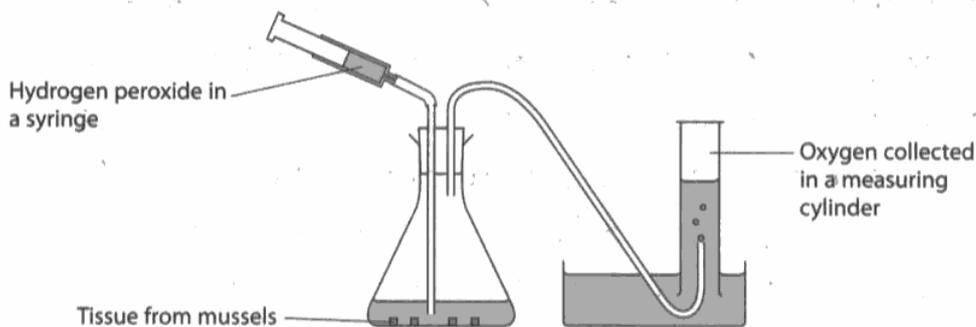
### ResultsPlus Examiner Tip

When describing experiments be clear about your dependent and control variables, and avoid the term *amount*.

This response scored all four marks available.

(b) Catalase activity in tissue from mussels can be studied using the apparatus shown below.

Tissue from mussels is placed in the flask and hydrogen peroxide is added using the syringe. The oxygen produced from the breakdown of hydrogen peroxide is collected in the measuring cylinder.



Describe how this apparatus could be used to compare the catalase activity in two different types of mussel.

(4)

You can set this up, with two separate sets of identical apparatus, set up the same way and using the same volumes and measurements of mussel tissue, hydrogen peroxide and catalase. Catalase is added to the hydrogen peroxide in the syringe. This can then be added to the tissue, and the amount of oxygen given off can be measured (every minute in  $\text{cm}^3$ ). By dividing the amount of oxygen given off (in  $\text{cm}^3$ ) by time (minutes), for the first minute, you get the initial rate of reaction (in  $\text{cm}^3/\text{min}$ ). The two results, <sup>from the different mussel tissue</sup> can then be compared. This experiment should be repeated twice more and the average result taken to give a more reliable sample. (Total for Question 6 = 9 marks) Other variables such as temperature should also be kept constant.



### ResultsPlus

Examiner Tip

This candidate clearly states a variety of clear variables to control, and has demonstrated a clear understanding of how they could calculate an initial rate of reaction. They have also recognised the value of repeats. Although 'amount of oxygen' is not clear enough for credit for the dependent variable alone, this response would have just been given credit as they have qualified their answer by stating what units to use.

## Question 7 (a)

This was answered very well by many candidates, who had obviously learned and understood the stages of atherosclerosis well. The majority of answers were set out in a logical order and therefore met the QWC criteria for this question. There were, however, some weak descriptions, which still managed to pick up 1 or 2 marks. Marks were often lost for vague descriptions which did not refer to the endothelium or lining of the artery OR which did not refer to the artery but only to the endothelium. A number of candidates also referred to narrowing of the artery rather than the lumen of the artery, thus losing a mark. Some extremely vague answers referred to 'reducing the size of the artery'.

Some candidates spent most of their time describing the blood clotting process rather than atherosclerosis.

This response scored all four marks available.

7 Cardiovascular disease (CVD) is responsible for many deaths.

\*(a) One cause of CVD is atherosclerosis. Describe how atherosclerosis develops. (4)

When Endothelial cells are damaged, there is an inflammatory response. White blood cells accumulate. Cholesterol also builds up at site. Calcium ions and fibrous tissue also build up, causing the atheroma to harden, resulting in a plaque. The blood vessel's wall has now lost flexibility, and this results in higher blood pressure. This is a self-perpetuating process.



### ResultsPlus Examiner Comments

This candidate has included nearly all points we were looking for in a logical sequence. The only significant omission is that they did not state that the endothelial cells are in the artery.



### ResultsPlus Examiner Tip

When a question is marked as a QWC response make sure you set your answer out in a logical sequence (like this example), as well as taking care over the spelling of key terms used.

## Question 7 (b) (i)

Approximately only a third of candidates managed to explain the meaning of the term genotype, despite this being such a widely used term.

This is an example of a response that scored the mark.

(b) A number of factors have been identified that increase the risk of CVD.  
One of these factors is genetic.

The genotype of some individuals causes them to be more at risk of developing CVD. One gene that influences this risk is the *KIF6* gene. Carriers of the 719 Arg allele of this gene are more at risk of CVD.

(i) Explain the meaning of the term **genotype**. (1)

Is the combination of the alleles inherited from your parents of different genes eg: could be homozygous or heterozygous.



### ResultsPlus Examiner Comments

This is a typical good response that explained genotype in terms of the alleles an individual has.

Although not a very clear definition, this is how genotype is often described in a variety of textbooks, so this has been judged acceptable for the mark.



### ResultsPlus Examiner Tip

Although this was accepted, it is far better to provide a clear explanation of the term, with reference to the alleles present in an organism.

This is an example of a response that failed to achieve the mark.

- (b) A number of factors have been identified that increase the risk of CVD.  
One of these factors is genetic.

The genotype of some individuals causes them to be more at risk of developing CVD. One gene that influences this risk is the *KIF6* gene. Carriers of the 719 Arg allele of this gene are more at risk of CVD.

- (i) Explain the meaning of the term **genotype**.

(1)

The coding for a gene.



**ResultsPlus**  
Examiner Comments

Many candidates related answers to coding, or what the gene 'looks like', demonstrating a poor understanding of the term which is widely used.

### Question (7) (b) (ii)

More candidates correctly explained the meaning of the term allele.

(ii) Explain the meaning of the term **allele**.

part of a gene



**ResultsPlus**

**Examiner Comments**

This is typical of the many incorrect explanations. Many candidates referred to coding, parts of genes or parts of chromosomes, without reference to alleles being different forms of a gene.

(ii) Explain the meaning of the term **allele**.

(1)

is an alternative form of a particular gene.



**ResultsPlus**

**Examiner Comments**

This is a typical example of a good credit worthy response.

## Question 7 (c)

In this question, candidates were asked to identify two factors that increase the risk of developing CVD. Both factors named by the candidates needed to show clearly the increased risk of CVD. For example smoking and obesity are both conditions that clearly increase risk of CVD, however salt, diet, activity, etc by themselves do not increase the risk. These factors therefore need to be qualified e.g more salt, higher saturated fat consumption, lack of exercise, become factors that increase risk.

Almost three quarters of candidates managed to identify two clear factors to gain the mark.

This is an example of a response that did not gain the mark.

(c) Give **two** factors, other than genetic factors, that increase the risk of developing CVD. (1)

Age: The older you are the greater the risk.  
Diet: A poor diet increases the risk of CVD.



### ResultsPlus Examiner Comments

The comment about age is good in this response and has a clear direction for the increased risk. Unfortunately poor diet is too vague to be given credit.



### ResultsPlus Examiner Tip

When describing aspects of diet and risk for CVD, be as specific as possible e.g. increased saturated fat intake.

(c) Give **two** factors, other than genetic factors, that increase the risk of developing CVD. (1)

A diet high in saturated fats  
smoking



### ResultsPlus Examiner Comments

An example of a good response with two clear factors to gain the mark.

## Question 7 (d)

This was well answered by many candidates who collectively identified many of the risks associated with the use of plant statins. The most common correct responses referred to liver, kidney and muscle problems. Nausea and constipation were also commonly identified.

Incorrect responses commonly referred to an increased risk of cancer, or the effects on blood pressure and vitamin absorption.

This response scored both available marks.

(d) Trials have shown that plant statin therapy is more effective in 719 Arg carriers than in non-carriers of this allele.

Describe the risks of using plant statins to treat CVD.

(2)

They can ~~reduce~~ inhibit the uptake of vitamins in the gut.

They can also cause liver and kidney problems.



**ResultsPlus**  
Examiner Comments

This candidate has correctly recognised the risks of liver and kidney problems associated with statin use. However they also make reference to one of the most common errors of thinking they inhibit vitamin uptake.

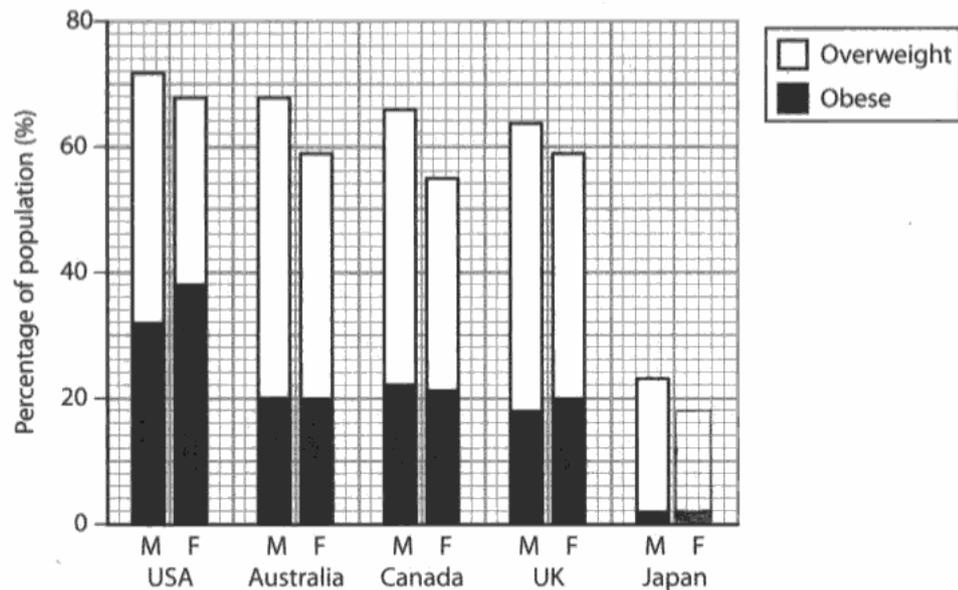
## Question 8 (a)

Candidates generally gained all 3 marks here for clear drawings on the chart. However a significant minority only gained 2 marks. The most common error was plotting the overweight bar at 18%. A small minority of candidates left this answer blank, despite further reference to this data in 8c.

This response scored two of the three marks available.

- 8 Obesity is a significant problem in western countries and an increasing problem in some other parts of the world.

The graph below shows the percentage of the male population (M) and the female population (F) who are either overweight or obese in five different countries.



- (a) The graph above shows that in Japan 2% of the male population are obese and 23% are overweight.

In the female population of Japan, 2% are obese and 16% are overweight.  
Add this information to the graph above.

(3)



**ResultsPlus**  
Examiner Comments

This response has plotted the percentage of obese women correctly, and clearly identified the obese and overweight proportions through their shading. However, they have plotted the overweight women at 18% rather than 16%.



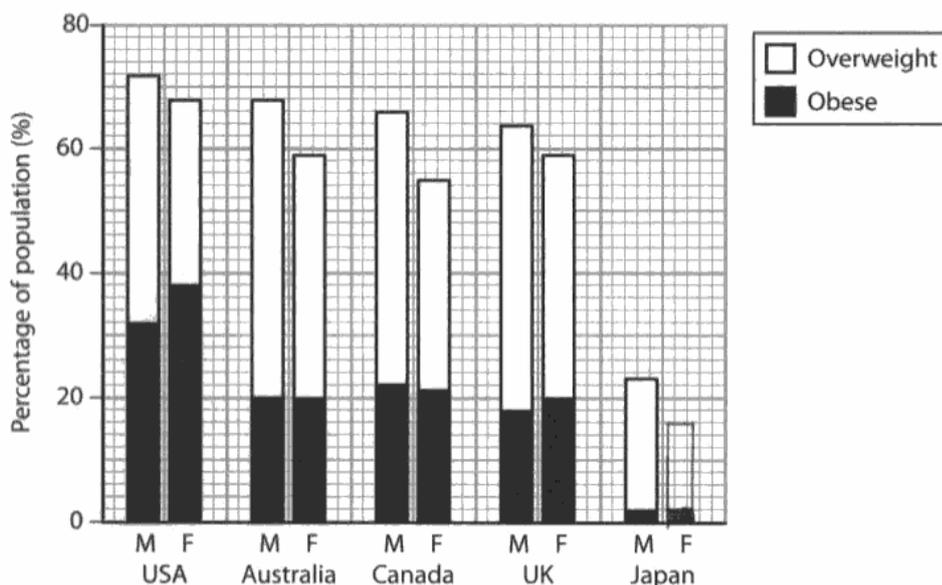
**ResultsPlus**  
Examiner Tip

All information in a question stem is provided for a reason so read it carefully. In this case you are given the details of the percentages of men who are overweight and those who are obese which have been plotted on the graph. This should provide evidence for the way in which the information has been plotted, which together with understanding that people who are obese are a subset of people who are overweight should help you decide where to plot the bar for the data provided

This response scored all three marks available.

- 8 Obesity is a significant problem in western countries and an increasing problem in some other parts of the world.

The graph below shows the percentage of the male population (M) and the female population (F) who are either overweight or obese in five different countries.



- (a) The graph above shows that in Japan 2% of the male population are obese and 23% are overweight.

In the female population of Japan, 2% are obese and 16% are overweight. Add this information to the graph above.

(3)



**ResultsPlus**  
Examiner Comments

The majority of candidates gained all three marks for plotting a chart like this.

### Question 8 (b)

The vast majority of candidates scored all four marks for the multiple choice questions in 8 (b). It should be noted that for 8 (b) (iv), we accepted either C or A for the answer.

If candidates read through the whole question, they would have realised from the stem of question 8 (a) that the data on the bar chart has been presented with the percentage of people who are obese as a subset of the percentage of the population who are overweight. (You can be overweight without being obese, but you can't be obese without being overweight.) Comparing the two populations provides a ratio of 18:17 (response C).

However, if candidates only referred to the bar chart and key to help them answer this question they could easily interpret obese and overweight as discrete categories. Comparing the size of the white regions of the bars alone results in a ratio of 4:3 (response A).

The vast majority of candidates answered either C or A, with only a few getting the ratio the wrong way round and therefore failing to score the mark.

## Question 8 (c)

Most candidates correctly stated that there may be a different number of males to females in the population for one mark. Many candidates scored a second mark for either stating that the graph only provides information about percentages or that we do not know what the population size is.

A few candidates stated that there were no females who were obese or overweight, probably because they left 8a blank and did not read the full question thoroughly.

This response scored both marks available.

(c) Explain why it would be incorrect to conclude that, in Japan, the same number of males as females are obese.

(2)

We do not know how many people took part in the survey. Also the graph gives the percentage not the actual number of people - in Japan they may be more males than females.



**ResultsPlus**

**Examiner Comments**

This candidate identified all three points we were looking for in their response.



**ResultsPlus**

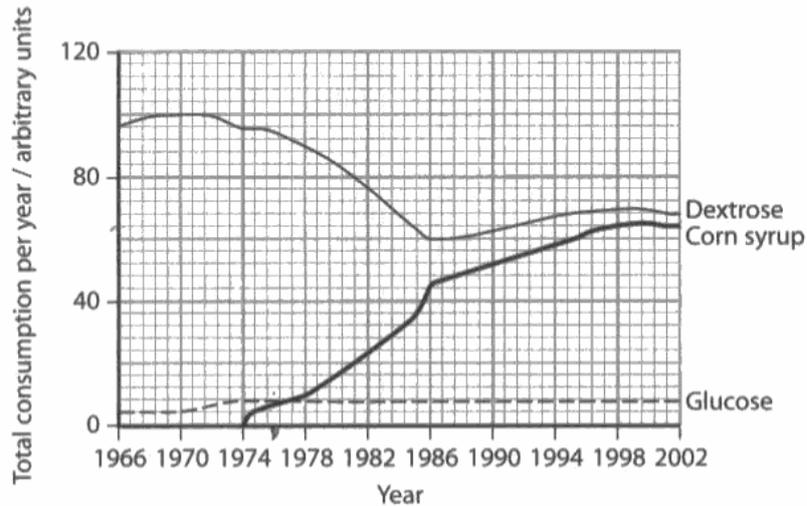
**Examiner Tip**

Make sure you read the whole of the question through thoroughly and check all data included with the question.

### Question 8 (d) (i)

There were some very good definitions of the term correlation, but it was disappointing that so many candidates described a causal relationship. Others simply defined it in terms of positive correlation – using the term in the question stem.

(d) The graph below shows the consumption of three types of sweetener in the USA, from 1966 to 2002.



From 1976, the number of obese people in the USA started to increase rapidly. It was suggested that there was a correlation between the consumption of corn syrup and obesity.

(i) Explain the meaning of the term **correlation**.

(1)

There is a relationship between two variables, as one variable changes so does the other variable, but one change doesn't necessarily cause the change in the other variable.

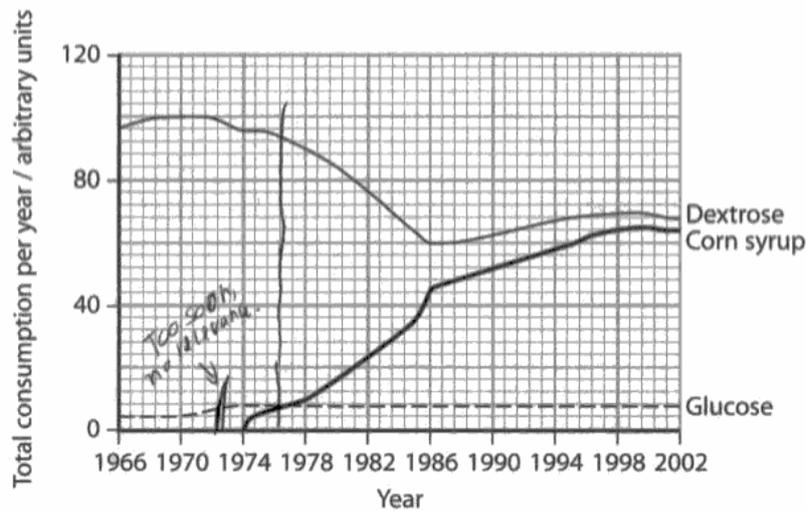


**ResultsPlus**  
Examiner Comments

This is an example of a good definition that gained the mark.

This response did not score the mark.

(d) The graph below shows the consumption of three types of sweetener in the USA, from 1966 to 2002.



From 1976, the number of obese people in the USA started to increase rapidly. It was suggested that there was a correlation between the consumption of corn syrup and obesity.

(i) Explain the meaning of the term **correlation**.

(1)

When there is a noticeable link between two groups of data.



### ResultsPlus Examiner Comments

This is an example of one of the very common incorrect definitions seen.



### ResultsPlus Examiner Tip

Correlation is an important term that candidates should learn how to define.

### Question 8 (d) (ii)

The majority of candidates scored one mark easily for recognising the increase in the consumption of corn syrup. Better candidates recognised that the rise in obesity started two years after the initial rise in corn syrup consumption. Only a few candidates described what was happening to dextrose and/or glucose consumption compared to corn syrup and the timing of the rise in obesity.

This response scored one of the three marks available.

(ii) Using the information in part (d), describe the evidence that suggests there is a correlation between the consumption of corn syrup and obesity.

(3)

The graph shows that there has been an increase in the consumption of corn syrup since 1974. This could show a correlation as the problem of obesity is getting worse as more people are overweight and obese. This shows a pattern between both sets of data because they have both increased. But does not prove that an increase in the consumption of corn syrup is the result in an increase in obesity.

(Total for Question 8 = 13 marks)



**ResultsPlus**

**Examiner Comments**

This response is typical of the many candidates who only identified the increase in corn syrup consumption, and therefore only scored one mark.



**ResultsPlus**

**Examiner Tip**

When you are asked to use the information provided you should make reference to as much of it as possible, particularly when the question is worth more than one mark.

This response scored all three marks available.

(ii) Using the information in part (d), describe the evidence that suggests there is a correlation between the consumption of corn syrup and obesity.

(3)

From 1974 - 2002 the total consumption of corn syrup has been increasing, from 0-64 arbitrary units. ~~As sweeteners contain~~ Too much of saturated fat leads to obesity. ~~due to an increase in atherosclerosis, formation~~ The total consumption of glucose stayed the same from 1974 - 2002. However, dextrose's total consumption steeply decreased from 1974 - 1986, but then started to increase from 1986 - 2002.



**ResultsPlus**  
Examiner Comments

This candidate has made correct statements about the trends of all three sweeteners during the time of the rise of obesity, and has therefore gained three marks. However, they did not spot that the rise in obesity follows two years after the initial increase in corn syrup consumption.

## Paper Summary

To help candidates prepare for this paper in future please encourage them to:

- read the whole question carefully, including the introduction, to help relate their answers to the context asked. Don't just skim-read the question, picking out the key words. Read the question through carefully at least once and then write down your knowledge in a way that answers the question;
- include a calculation whenever they are asked to describe or compare numerical data (particularly data presented in graphs);
- make use of a calculator to lend precision to their calculations in data handling questions;
- include relevant units in answers when quoting or calculating numerical data;
- familiarise themselves with the How Science Works criteria in the specification as well as the topic content;
- 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 and organisation of their answer in QWC labelled questions;
- explore and assess examples of candidate responses from this report to help them understand what makes a good response to different types of question, and exemplify the level of knowledge and understanding expected at AS level.

If candidates need more space than is available, please remind them not to write in the margins of the paper and that they need to clearly indicate that their answer continues in another point in the paper, or on an extra sheet.

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