

Examiners' Report  
June 2015

GCE Biology 1 6BI01 01

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## Introduction

This paper tested the knowledge and understanding of the two AS topics: 'Lifestyle, health and risk' and 'Genes and health', together with elements of 'How Science Works'. The range of questions provided plenty of opportunity for candidates to demonstrate their grasp of these AS topics. The paper appears to have worked very well with most questions (for example some of the multiple choice questions) achieving the full spread of marks. Very few questions were left blank and there was no evidence in the majority of papers that candidates had insufficient time to complete the paper. Most candidates were able to score marks on each question and as a result the mean mark for the paper was 5.6 higher than the equivalent 2014 paper.

A significant issue for some candidates on this paper was not reading the question carefully and in particular ignoring the command words such as describe and explain; with candidates often describing data when they had been asked to explain something, or describing a set of data with no reference being made to the data provided.

Some candidates lost marks through poor literacy; others through carelessness, for example by not making a clear comparative statement, or only making one clear statement when a question carried two or more marks.

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

## Question 1 (a)

Most candidates understood the context of what a template is, but often struggled to express what is meant by a template. Some just restated the question and others referred to copying and making an identical strand. However, many did express the idea of nucleotides lining up along one strand of DNA by complementary base pairing to gain credit.

Q1 (b) The multiple choice questions were reasonably discriminating, for example with only about 65% of candidates correctly calculating the percentage of adenine in the sample.

Contain ribose" and "transcription and replication can occur at the same time" were the most common incorrect responses for (i) and (ii).

This response gained the mark.

- 1 One function of DNA is to act as a template for the synthesis of messenger RNA.  
(a) State what is meant by the term **template** for the synthesis of messenger RNA.

The template DNA acts as a guide for the RNA nucleotides to bind by complementary base pairing to form a strand of mRNA. (1)



**ResultsPlus**  
Examiner Comments

This is an example of the type of definition we accepted.

This response gained no marks.

- 1 One function of DNA is to act as a template for the synthesis of messenger RNA.  
(a) State what is meant by the term **template** for the synthesis of messenger RNA.

The term template for the synthesis of messenger RNA is a strand which acts like a template where RNA copies the exact strand and makes a brand new identical one. (1)



**ResultsPlus**  
Examiner Comments

This is a typical example of a response that gained no credit as the candidate describes the process of using the template to make an identical copy rather than a complementary strand.

This response gained no marks.

1 One function of DNA is to act as a template for the synthesis of messenger RNA.

(a) State what is meant by the term **template** for the synthesis of messenger RNA.

(1)

The sequence of bases that are identical to the DNA molecule which is used to find the complementary base for RNA where U replaces T.



**ResultsPlus**

**Examiner Comments**

The sequence is complementary not identical to the DNA so no credit for this response. This response also implies that the template is something other than the DNA strand.

### Question 1 (c)

The vast majority of candidates managed to gain both marks available for this question on transcription.

This response gained both marks available.

(c) The DNA base sequence for part of a gene is shown below. AT CG

|   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | C | T | T | T | C | G | C | C | C | G | A |
|---|---|---|---|---|---|---|---|---|---|---|---|

Write the mRNA base sequence produced from this sequence of bases. (2)

|   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T | G | A | A | A | G | C | G | G | G | C | T |
|---|---|---|---|---|---|---|---|---|---|---|---|



**ResultsPlus**  
Examiner Comments

An example of the correct response.

This response scored just one of the two marks.

(c) The DNA base sequence for part of a gene is shown below.

|   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | C | T | T | T | C | G | C | C | C | G | A |
|---|---|---|---|---|---|---|---|---|---|---|---|

Write the mRNA base sequence produced from this sequence of bases. (2)

|   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|
| U | G | A | A | A | G | C | G | G | G | C | U |
|---|---|---|---|---|---|---|---|---|---|---|---|



**ResultsPlus**  
Examiner Comments

This is an example of the most common mistake with this question where the candidate did not recognise that Uracil (U) replaces Thymine (T) in RNA; or they thought this was replication.

This response gained no marks.

(c) The DNA base sequence for part of a gene is shown below.

|   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | C | T | T | T | C | G | C | C | C | G | A |
|---|---|---|---|---|---|---|---|---|---|---|---|

Write the mRNA base sequence produced from this sequence of bases.

(2)

|   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | C | U | U | U | C | G | C | C | C | G | A |
|---|---|---|---|---|---|---|---|---|---|---|---|



**ResultsPlus**

**Examiner Comments**

This candidate recognised that U replaces T in RNA, but did a direct copy, rather than recognising that complementary base pairing would form the mRNA.

## Question 1 (d)

Most candidates successfully compared the two processes often comparing the nucleotides, enzymes and sections of the DNA used. Others compared what was made, e.g. two double strands of DNA compared to a single strand of RNA and a few described and compared semi-conservative replication with transcription.

However, candidates often lost marks for not making a clear comparison or thinking that the processes took place in different parts of the cell (comparing transcription with translation). Some candidates concentrated on what is eventually produced (proteins and cells) or where the products went (e.g. outside the nucleus) which is not part of the process being compared.

This response gained all three marks available.

(d) Describe **three differences** between the **processes of replication and transcription** of DNA. (3)

- 1 DNA polymerase is used to join up the <sup>deoxyribo</sup> nucleotides in replication whereas RNA polymerase is used to join up the ribonucleotides in transcription.
- 2 short strand of mRNA is produced as the result of transcription whereas <sup>2</sup> long molecules of DNA is produced as the result of replication.
- 3 Only one strand of DNA (template strand) is used in transcription whereas both strands <sup>of DNA</sup> are used in replication.



### ResultsPlus Examiner Comments

This response did not get credit for the opening statement as deoxyribonucleotides and ribonucleotides are not suitable names of the components for comparison. However, they have gone on to give three valid comparisons:

- enzymes used
- comparisons about the nature of what is produced - short single strand compared to two long molecules
- comparisons about what sections of the DNA are used for each process.



### ResultsPlus Examiner Tip

When asked to describe differences make sure your response refers to both things being compared.

This response gained one of the three marks available.

(d) Describe **three** differences between the processes of replication and transcription of DNA.

(3)

- 1 In replication DNA polymerase is used but in transcription RNA polymerase is used
- 2 In transcription mRNA strand is transcribed and it diffuses out of the nucleus to attach to a ribosome but this doesn't happen in replication.
- 3 transcription can be used to make new proteins but replication is only to copy a DNA.



**ResultsPlus**  
Examiner Comments

This response gained credit for the comparison of the enzymes involved. However, the rest of the response is not worth credit because it describes what happens as a result of the processes rather than comparing the processes themselves.

This response gained one mark.

(d) Describe **three** differences between the processes of replication and transcription of DNA.

(3)

1. In DNA replication new cells are <sup>made</sup> which contain half the information of the original cell. In transcription the DNA is only copied and no new cells are formed.
2. In transcription mRNA are formed by copying section of the DNA whereas in DNA Replication mRNA are not used or formed.
3. In transcription a section of the DNA is unzipped whereas in replication, the entire double helix strand is unzipped.



**ResultsPlus**  
Examiner Comments

This response gained a mark for the comparison made about how much of the DNA is 'unzipped'. Replication is not only used in meiosis and we are interested in the process not what is eventually made after the process (cells or proteins). mRNA formed was not sufficient for credit for the comparison of the processes.

## Question 2 (a)

Most candidates had few difficulties in describing what was meant by recessive; either describing the need to be homozygous, or that it could not be expressed in the presence of a dominant allele. However, many candidates did not make it clear what is meant by the term allele. Those who did tended to recognise that they were different forms of the same gene. Few candidates gained the third and final mark for some further detail, e.g. recognising that the alleles are at the same locus or have a different base sequence.

This response gained all three available marks.

- 2 The photograph below shows a cleft iris, a rare condition in humans. Cleft iris may be due to the inheritance of recessive alleles.



Magnification  $\times 1$

- (a) Explain the meaning of the term **recessive allele**.

*a specific locus<sub>(3)</sub>*  
A type allele is a variation of a particular gene found on.  
A recessive allele must be ~~the~~ homozygous to be displayed in the phenotype. ~~of the organism by coding for a particular gene~~ If it is heterozygous it has no effect. This is because only the dominant allele will code for the specific gene.



**ResultsPlus**

**Examiner Comments**

This response makes it clear what an allele is - variation of a particular gene (one mark) and found at a specific locus (one mark). As well as recognising what it means to be 'recessive' (one mark).



**ResultsPlus**

**Examiner Tip**

When terms are highlighted in bold make sure you explain all highlighted words.

This response gained two of the three marks available.

- 2 The photograph below shows a cleft iris, a rare condition in humans. Cleft iris may be due to the inheritance of recessive alleles.



Magnification  $\times 1$

- (a) Explain the meaning of the term **recessive allele**.

(3)

A recessive allele is only ~~present~~ expressed if the individuals genotype is homozygous. ~~with~~ A recessive allele is ~~the~~ <sup>only</sup> produced if both parents are carriers (have a heterozygous genotype) or one suffers. A recessive allele is a different form of the gene. Will only be expressed if the dominant allele is not present.



**ResultsPlus**  
Examiner Comments

This response illustrates the mistake that some candidates made in describing the recessive allele in terms of inheritance from the parents rather than expression in the phenotype.

An allele is also not part of a gene.

This response gained no credit.

- 2 The photograph below shows a cleft iris, a rare condition in humans. Cleft iris may be due to the inheritance of recessive alleles.



Magnification  $\times 1$

- (a) Explain the meaning of the term **recessive allele**.

(3)

~~A recessive allele is a part of a gene.~~  
An allele is a part of a gene that codes for a certain trait for example hair colour. A recessive allele, therefore is an allele that requires both parents to have this allele in order for the trait to be produced. If both parents do have this recessive allele, then the child is more likely to develop this trait.



**ResultsPlus**  
Examiner Comments

This response is a typical example of the responses that clearly recognised what recessive meant and that it is one form of a gene.

## Question 2 (b) (i)

Almost all candidates appeared to understand the principles behind the genotypes and the use of a genetic diagram to establish the genotypes of the potential offspring. However, a significant number failed to follow the rubric of the question and only showed the genotypes and not the phenotypes. This was particularly so for the parental phenotypes (although the genotypes were correct). Consequently, many gained only two marks for showing the parental gametes and the possible crosses for the offspring's genotypes. This was usually written in the form of the Punnett square, which was acceptable.

This response gained all four available marks.

- (b) (i) In the space below, draw a genetic diagram to show the genotypes and phenotypes of a man with cleft iris and a woman who is heterozygous for this condition, and all their possible children. (4)

|           | Man                           | Woman                              |
|-----------|-------------------------------|------------------------------------|
| Phenotype | Affected<br>(with cleft iris) | Unaffected<br>(without cleft iris) |
| Genotype  | tt                            | Tt                                 |
| Gametes   | t, t                          | T, t                               |

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
|                          | $\text{\textcircled{t}}$ | $\text{\textcircled{t}}$ |
| $\text{\textcircled{T}}$ | Tt                       | Tt                       |
| $\text{\textcircled{t}}$ | tt                       | tt                       |

Genotype of children : Tt, Tt, tt, tt  
(50% Tt, 50% tt)

Phenotype of children : 50% unaffected, 50% affected.

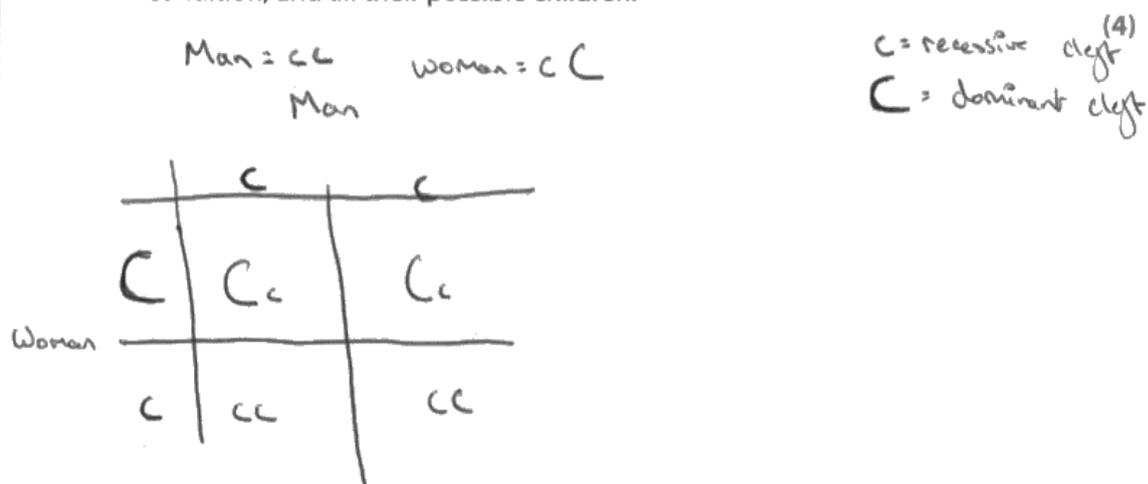


### ResultsPlus Examiner Comments

This response has clearly identified and linked the genotypes and phenotypes of the parents and offspring and carried out the genetic cross correctly using a Punnett square.

This response gained two marks.

- (b) (i) In the space below, draw a genetic diagram to show the genotypes and phenotypes of a man with cleft iris and a woman who is heterozygous for this condition, and all their possible children.



**ResultsPlus**

**Examiner Comments**

This response is typical of the many responses that drew a correct genetic cross so gained marks for the gametes and genotypes of the offspring, but made no attempt to link genotypes and phenotypes together for either the parents or offspring.



**ResultsPlus**

**Examiner Tip**

To demonstrate that you understand genetic crosses it is always good practice to fully label everything. In particular make sure you clearly link the genotypes and phenotypes of both the parents and potential offspring of the cross, especially when it is asked for specifically in the question stem!

This response gained just one of the four marks available.

(b) (i) In the space below, draw a genetic diagram to show the genotypes and phenotypes of a man with cleft iris and a woman who is heterozygous for this condition, and all their possible children.

~~AA~~ aa      Aa      (4)

Man = aa  
Woman = Aa

|   |     |    |
|---|-----|----|
|   | Man |    |
|   | a   | a  |
| A | Aa  | aa |
| a | aa  | aa |

75% chance  
~~chance~~



**ResultsPlus**  
Examiner Comments

Some candidates (like this one) correctly identified the genotypes and therefore gametes of the parents, but then made mistakes in completing the cross, e.g. via a Punnett square.

## Question 2 (b) (ii)

There were very few issues with this question with over 90% of candidates gaining the mark for the probability. Those who did lose the mark either did it through making a mistake on the genetic cross, or by expressing a ratio rather than a probability.

This response gained the mark.

(ii) State the probability that the first child of these parents will have a cleft iris. (1)

50%.



**ResultsPlus**

**Examiner Comments**

The vast majority of responses gave a correct probability like this response.

An example of an incorrect response.

(ii) State the probability that the first child of these parents will have a cleft iris. (1)

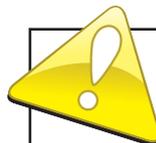
25% probability.



**ResultsPlus**

**Examiner Comments**

This error was a result of assuming that both parents were heterozygous and therefore not reading the information given in the question.



**ResultsPlus**

**Examiner Tip**

With genetics questions, always read the context carefully to work out the genotypes of the parents to use in the cross.

### Question 3 (a) (i)

Most candidates scored full marks for transparent/less developed nervous system/correct ethical concerns. Mark point 5 was just missed by some who stated that as *Daphnia* are small the chemical affects them, with no reference to speed of effect or absorption.

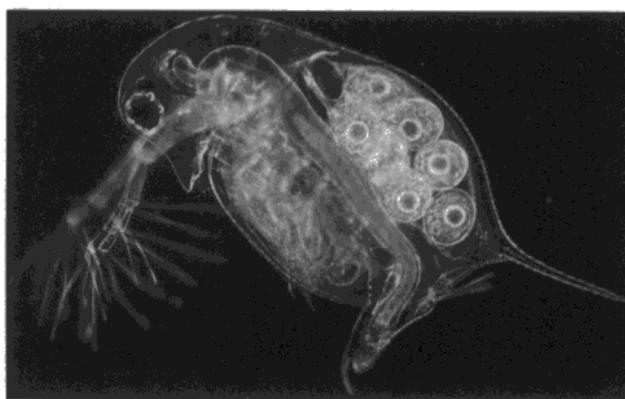
Some candidates discussed that the circulatory system being a useful comparison to humans despite the question not asking about modelling the effects on humans; with some even implying that *Daphnia* have a double circulatory system.

Just because *Daphnia* are small they are not necessarily better/easier to use. For example it will be easier and less stressful to measure a human pulse rate than having to immobilise a *Daphnia* under a microscope.

A few candidates thought that *Daphnia* are unicellular or have no nervous system at all.

This response gained both available marks.

- 3 The photograph below shows *Daphnia* (a water flea). *Daphnia* can be used to investigate the effect of chemicals on heart rate.



Magnification  $\times 30$

- (a) (i) Give **two reasons** why *Daphnia* is a suitable organism for investigating the effect of chemicals on heart rate.

(2)

- 1 They have a transparent body in which the heart can be seen, ~~and because~~ this allows the heart rate to be easily measured under a microscope.
- 2 They do not have a complex nervous system, so it is not unethical to use them in investigations as they are simple organisms and 'do not' necessarily ~~have~~ feel pain.

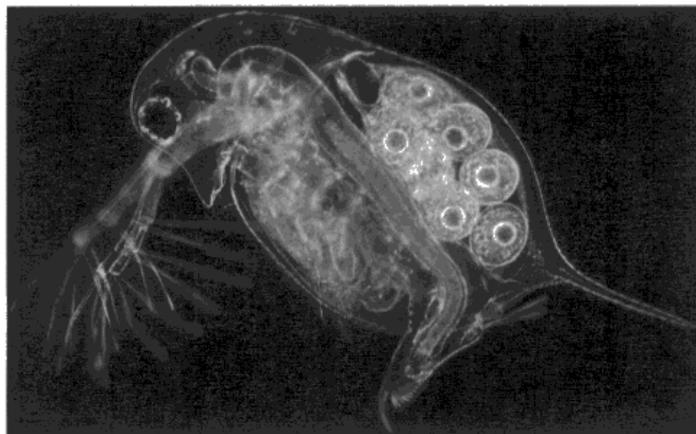


**ResultsPlus**  
Examiner Comments

This response gains credit for recognising the benefits of the transparent body so you can see the heart, and recognising that it has a less complex nervous system so there are less ethical issues in using them.

This response gained one mark.

- 3 The photograph below shows *Daphnia* (a water flea). *Daphnia* can be used to investigate the effect of chemicals on heart rate.



Magnification  $\times 30$

- (a) (i) Give **two** reasons why *Daphnia* is a suitable organism for investigating the effect of chemicals on heart rate.

(2)

- 1 because it's not seen as unethical to experiment with daphnia, compared to other animals such as a dog because they're not generally kept as pets.
- 2 ~~because~~ daphnia's skin is clear and you can easily see their heart beating through a microscope.



**ResultsPlus**  
Examiner Comments

This candidate has recognised the value of the transparent body for one mark. They have made an attempt at an ethical justification for using *Daphnia*, but many people will see it as unethical to use all sorts of animals that are not commonly kept as pets, e.g. a human or a hippo.

### Question 3 (a) (ii)

Two suitable variables were often identified but the accompanying descriptions of how to control them were often imprecise, unworkable or wrong.

Many candidates focussed upon controlling temperature by using a water bath or making sure that the room temperature did not fluctuate or get too warm, without really thinking about the context of the experiment.

The volume of caffeine was often stated as "amount" and the means of controlling it usually lacked a precisely stated volume. Similarly, the age, species, size, etc. of *Daphnia* when quoted as a variable was nearly always supported by unmanageable or unreasonable suggestions as to how to control it.

A significant number of candidates described why it was important to control a variable instead of describing how to control it.

This response gained all four marks.

(ii) State **two** variables that you would need to control for a valid investigation into the effect of caffeine on the heart rate of *Daphnia*.

Describe how to control each of these variables.

(4)

1. Variable The acclimatisation time.

How to control Set a fixed amount of time e.g. 60s timed with a stopwatch during each experiment to ensure it remains constant.

2. Variable Volume of caffeine solution

How to control use a pipette to apply the same volume of caffeine solution e.g. 1cm<sup>3</sup> of each time.



**ResultsPlus**  
Examiner Comments

This candidate states two clear variables and gave two clear methods of control. Although 60 seconds may not be enough time for acclimatisation, the candidate has been given credit for the principal behind how to control the variable.

This response gained three of the four available marks.

(ii) State **two** variables that you would need to control for a valid investigation into the effect of caffeine on the heart rate of *Daphnia*.

Describe how to control each of these variables.

(4)

1. Variable Temperature

How to control During to microscope using, only open the light ~~on the~~ under the microscope when is needed. Do not use of light will increase the temperature on Daphnia.

2. Variable time taken for <sup>Volume of Caffeine</sup> acclimatisation <sup>solution added</sup>

How to control Using a precise instrument to add the caffeine solution on Daphnia. e.g. pipette.



**ResultsPlus**

**Examiner Comments**

Two suitable control variables have been identified. This candidate gained credit for recognising that the reason the temperature may vary is due to the microscope light, so they gained credit for recognising how to try and control this.

They did not gain credit for their control method for the volume as they did not state that they would use the same volume - you can use a pipette to measure different volumes.



**ResultsPlus**

**Examiner Tip**

It is worth stating a value volume/mass, etc. that you would use when making it clear how you would control a variable where appropriate.

This response gained no credit.

(ii) State **two** variables that you would need to control for a valid investigation into the effect of caffeine on the heart rate of *Daphnia*.

Describe how to control each of these variables.

(4)

1. Variable ~~The caffeine concentration~~ amount of caffeine per ~~or daphnia~~

How to control ~~every time experimenting or daphnia, you need to ensure~~

~~has the caffeine concentration~~ ~~same~~ has the same amount

is per a using a pipette to measure how many drops and

how much the drops contain to give the same amount each time.

2. Variable ~~Beats~~ <sup>Number</sup> amount of beats per minute recorded accurately.

How to control Make sure has the same person is counting the

number of heart beats per minute.



**ResultsPlus**

**Examiner Comments**

This response has not identified a clear variable for control or suitable method of control.



**ResultsPlus**

**Examiner Tip**

At AS level never use amount as a variable as this is too vague and can't be measured. Use a variable such as volume or mass as a measurable variable.

### Question 3 (b)

Most candidates appreciated that a heart is needed to pump blood but often failed to qualify this further with reference to blood pressure or fast movement of blood. However, many did state that this was to transport oxygen which then gave them a mark.

Many candidates discussed the fact that diffusion would not be sufficient; often appreciating that this would be too slow or that *Daphnia*'s surface area to volume ratio was too small. Some candidates, however, described that the surface area to volume ratio was too large; and a few candidates thought that *Daphnia* are unicellular.

Occasionally references to mass flow, increased concentration gradient and high metabolic rate were seen.

This response gained all three available marks.

(b) Explain why many small animals, such as *Daphnia*, have a heart.

(3)

Hearts are required to pump blood around the body, so that substances can be transported to cells for metabolic processes (such as oxygen glucose for respiration). A heart is also required to maintain a high blood pressure, as well as homeostasis. Many small animals need a heart because they may have a too small surface area to volume ratio, and so cannot simply rely on diffusion to transport substances.



**ResultsPlus**

**Examiner Comments**

This response gained credit for recognising what blood transports; the heart provides high blood pressure; the surface area to volume ratio is too small for diffusion to meet their needs.

This response gained no marks.

(b) Explain why many small animals, such as *Daphnia*, have a heart.

Double circulatory system  
(3)

While mammals have a double circulatory system; small animals have a much simpler circulatory system. The simple version includes a pump (a heart) and blood vessels. In small animals the blood diffuses straight to where it is needed.



**ResultsPlus**

**Examiner Comments**

This is an example of the candidates who compared or described the circulatory system, rather than explaining why they need a heart and circulatory system.



**ResultsPlus**

**Examiner Tip**

Read the question and answer the question asked and not the one you hoped had been asked.

Make sure you know the difference between the command words explain and describe.

## Question 4 (a)

This was generally well answered, although only just over 40% of candidates gained all four marks. The most common mistakes included:

- thinking CFTR is a carrier protein
- chlorine or sodium instead of chloride
- not reading the last sentence and therefore writing respiratory as the missing system.

This response gained all four marks available.

**4** Cystic fibrosis is an inherited condition.

(a) Read through the following passage about cystic fibrosis then write on the dotted lines the most appropriate word or words to complete the sentences.

(4)

Cystic fibrosis is a disorder caused by one of a number of gene mutations.

The symptoms of the disorder are seen only in an individual who is

homozygous for the recessive allele. The gene codes for

a channel protein called CFTR. This protein is responsible for the

movement of chloride ions across the cell membranes. Cystic fibrosis

impairs the functions of the gaseous exchange, digestive and reproductive

systems in the body.



**ResultsPlus**  
Examiner Comments

This is an example of a fully correct response.

This response gained two marks.

4 Cystic fibrosis is an inherited condition.

(a) Read through the following passage about cystic fibrosis then write on the dotted lines the most appropriate word or words to complete the sentences.

(4)

Cystic fibrosis is a disorder caused by one of a number of gene mutations.

The symptoms of the disorder are seen only in an individual who is

genotype for the recessive allele. The gene codes for

a globular protein called CFTR. This protein is responsible for the

movement of chloride ions across the cell membranes. Cystic fibrosis

impairs the functions of the gaseous exchange, digestive and respiratory systems in the body.



**ResultsPlus**  
Examiner Comments

Credit was given for chloride ions and we allowed globular for the type of protein made. However, genotype is not suitable for the first gap and the respiratory system has effectively already been covered in the list of systems affected so an alternative was needed, i.e. the reproductive system.

### Question 4 (b)

Most candidates gave lengthy descriptions of the mechanisms involved which bring about thicker and stickier mucus, often only getting extra marks in the last few lines where they started to explain what effect this has on breathing. Some responses were not specific enough, writing about less oxygen to lungs or cells rather than alveoli or blood. Some candidates mentioned trapped bacteria but then failed to say what they would cause. A few confused villi and cilia. Some candidates used the word viscous without understanding what it meant, e.g. 'mucus becomes less viscous'.

Many candidates thought that the main effect of the mucus was to increase the diffusion difference for the oxygen rather than reducing air flow, etc.

This response gained all four marks available.

(b) Explain why people with cystic fibrosis can have breathing difficulties.

(4)

~~Explain~~ People with CF have a faulty CFTR protein and so the CFTR channel is faulty. Therefore the sodium channel protein is constantly open meaning that  $\text{Na}^+$  ions are constantly removed from the mucus in the trachea and bronchioles. The  $\text{Na}^+$  then diffuses into the tissue fluid because of the higher conc. in the cell.  $\text{Cl}^-$  also diffuses from the mucus to the tissue fluid through the epithelial cells. Water is drawn out of the mucus ~~also~~ via osmosis. The mucus is, <sup>therefore</sup> then sticky and viscous and <sup>the</sup> cilia cannot remove the mucus from the airways.

The surface area for diffusion in gaseous exchange is reduced and the mucus blocks the flow of air causing breathing problems. The lungs as a result expand and lose their elasticity causing a smaller volume of air not being able to be breathed in.



**ResultsPlus**  
Examiner Comments

The maximum four marks were awarded for:

- the mucus is stickier
- cilia are unable to move the mucus
- loss of surface area
- reduction in gaseous exchange.

They are also close to credit for reduced flow of air (but it should be clearer where the air should be flowing to - the alveoli) and the idea that the mucus causes a blockage (but they have not said where).

This response gained one of the four marks available.

(b) Explain why people with cystic fibrosis can have breathing difficulties.

(4)

People with cystic fibrosis have very sticky mucus. This is because they don't have a functioning CFTR protein. As the CFTR protein's not functioning, osmosis across the cell membrane can't happen. This means the  $\text{Na}^+$  ions can't move up through

the CFTR protein, therefore creating a sticky mucus. The mucus sticks to the situated endothelial cells in the airways, making it very difficult to breathe.



**ResultsPlus**

**Examiner Comments**

This is typical of the many responses that only really described why the mucus was sticky (one mark) and did not explain why this caused breathing difficulties.



**ResultsPlus**

**Examiner Tip**

Read the question carefully and make sure you address the question asked.

This response gained no marks.

(b) Explain why people with cystic fibrosis can have breathing difficulties.

(4)

Cystic Fibrosis means that they have a faulty channel protein called CFTR, this is responsible for the movement of ~~calcium~~<sup>chloride</sup>, if this protein is faulty it means that the ~~calcium~~<sup>chloride</sup> cannot get out of the cell membrane. This means that ~~calcium~~<sup>chloride</sup> is no longer getting around our body, ~~calcium~~<sup>chloride</sup> help us breathe because it



**ResultsPlus**

**Examiner Comments**

This candidate recognises that CFTR is involved in the transport of chloride ions, but they have ignored mucus and consider the transport of chloride around the body instead.

### Question 4 (c) (i)

Most candidates were able to name a suitable prenatal technique. There were, however, a significant number who still state "chronic" villus sampling.

Some candidates failed to make it clear that the amniotic fluid contained cells and/or DNA for testing, or did not know what was involved in chorionic villus sampling.

Others were too vague about testing the DNA and gave answers which included references to checking if the baby had CF or checking the DNA to see if it had mutations without noting that the allele or gene was being investigated.

A significant number answered this in terms of IVF and testing the embryo prior to implantation, or removing the foetus, testing it, and then returning it to the uterus. Others described parental testing or gene therapy.

This response gained all three marks available.

(c) Cystic fibrosis can be detected using prenatal genetic testing.

(i) Describe how **one** named method of **prenatal** genetic testing can be carried out.

(3)

Amino-centesis can be used. This involves removing amniotic fluid. ~~Amniotic~~ The amniotic fluid contain fetal cells, the sample is amplified. ~~The presence~~ ~~for~~ ~~the~~ ~~defective~~ The DNA is ~~one~~ analysed and the presence of the defective CFTR gene is tested for.



#### ResultsPlus Examiner Comments

Credit was given for:

- naming a suitable technique
- describing how cells were obtained for testing
- analysing the DNA for the presence of the CFTR gene.

(before birth)  
↑

(c) Cystic fibrosis can be detected using prenatal genetic testing.

(i) Describe how **one** named method of **prenatal** genetic testing can be carried out.

(3)

- DNA samples can be obtained from the mother & father of the child to see if they are carriers & the probability of the child getting cystic fibrosis can be worked out.

- The parents can give blood samples, cheek swabs to obtain the DNA.



**ResultsPlus**  
Examiner Comments

Instead of a prenatal test this candidate has described testing preconception.

This response did not gain any marks.

(c) Cystic fibrosis can be detected using prenatal genetic testing.

(i) Describe how **one** named method of **prenatal** genetic testing can be carried out.

(3)

Pre-implantation genetic diagnosis<sup>(PIGD)</sup> is a method of prenatal genetic testing. The sperm and egg are fertilised in an IVF process (in vitro fertilisation), and the developing embryo's DNA is then analysed for signs of genetic diseases, such as cystic fibrosis. Based on the results of the genetic screening and analysis, the parents will decide whether or not to go through with the pregnancy. If they decide that they do want to go through with it, the embryo is inserted ~~back~~ into the mother's womb to continue its development.



**ResultsPlus**  
Examiner Comments

This is an example of a candidate who has described a pre-implantation technique instead of a prenatal test.

### Question 4 (c) (ii)

Two thirds of candidates managed to gain both of the available marks. Normally for recognising that the choice of an abortion or risk of a miscarriage caused an ethical or social concern. Other candidates identified the risk of false positive or negative results and their potential consequence.

Where candidates did not gain the mark they sometimes listed several ethical or social concerns without explaining them and a few still refer to designer babies and playing God.

This response gained both available marks.

(ii) Explain **either** one ethical issue **or** one social issue relating to the use of prenatal genetic testing.

(2)

~~It allows the parents to make an informed choice about their child's future. E.g. medical treatment that maybe available~~

A false result:

- A false positive may result in the abortion of a healthy child.

- A false negative would take away the parents' informed choice about a child with illnesses/disabilities



**ResultsPlus**  
Examiner Comments

This response gives the consequences of both a false positive and a false negative result, only one of which would have been needed for full credit.

This response gained one of the two available marks.

(ii) Explain **either** one ethical issue **or** one social issue relating to the use of prenatal genetic testing.

If the ~~para~~ prenatal genetic testing (2)  
comes back positive and you a genetic  
disorder such as cystic fibrosis, the  
baby could be aborted.



**ResultsPlus**  
Examiner Comments

This example is typical of the many responses that recognised that an abortion may be carried out as a result of the test, but has not explain why this may be considered unethical.

This response gained no marks.

(ii) Explain **either** one ethical issue **or** one social issue relating to the use of prenatal genetic testing.

In vitro fertilisation can be used by parents to manipulate the phenotype (2)  
of their offspring, for example blonde hair, green eyes.



**ResultsPlus**  
Examiner Comments

Although the candidate has identified an ethical issue related to genetic testing it is not relevant to the context of this question.



**ResultsPlus**  
Examiner Tip

Make sure you are clear about the context of the question being asked.

### Question 5 (a) (i)

Over 90% of candidates got this question correct. The only issues were some candidates forgot to square the height in the formula and some used inappropriate numbers of significant figures, or made errors in rounding their numbers.

This response gained the mark.

- (i) Calculate the BMI of a person who has a mass of 95 kg and a height of 1.75 metres.

$$\text{BMI} = \frac{95}{(1.75)^2} \quad (1)$$

$$= 31.0204$$
$$= 31.02 \text{ (kg/m}^2\text{)}$$

Answer 31.02 (kgm<sup>-2</sup>)



**ResultsPlus**  
Examiner Comments

This candidate clearly shows the calculation and the correct result.

This response gained no marks.

- (i) Calculate the BMI of a person who has a mass of 95 kg and a height of 1.75 metres.

$$\frac{95}{1.75} = 54.285714$$
$$= 54.3 \text{ (1dp)}$$

(1)

Answer 54.3



**ResultsPlus**  
Examiner Comments

This is an example of the most common mistake where the candidate has forgotten to square the height.

### Question 5 (a) (ii)

Almost all candidates used the data in the table correctly to decide the class, if they made an error in 5(a)(i) they correctly used their value for determining the category.

This response gained the mark.

- (i) Calculate the BMI of a person who has a mass of 95 kg and a height of 1.75 metres.

(1)

$$\frac{95}{(1.75)^2} = 31.02$$

Answer 31.02

- (ii) Use your calculated value and the information in the table to find the category of this person.

(1)

Category obese class 1



**ResultsPlus**  
Examiner Comments

An example of the correct response.

### Question 5 (a) (iii)

This question was assessed for the quality of written communication and in this case we looked specifically for the spelling of key terms. Spelling was generally good for most candidates. However, common errors were for the spelling of atherosclerosis and inflammatory, which caused these candidates to lose the marking point.

Most candidates addressed the idea of damage to the arteries but often were too imprecise to gain the marking point. For example, reference to blood vessels rather than specifically to arteries, damage to the artery wall without reference to the endothelium or mention of damage to the endothelial wall or cells rather than to the lining.

Many candidates appreciated and described correctly the loss of elasticity of the artery. Others were too imprecise when referring to the narrowing of arteries by not referring to the lumen.

Many candidates also addressed the nature of the positive feedback effect correctly. Similarly, reference to blood clotting or a detailed description of the clotting cascade was often seen.

This response gained all four marks available.

\*(iii) People in this category are more likely to develop high blood pressure than people with a healthy weight.

Explain why someone who has a high blood pressure is at a significantly higher risk of developing CVD.

(4)

High blood pressure can result in damage to the endothelium of ~~the~~ arteries, triggering an inflammatory response where white blood cells move to the damaged area and cholesterol to accumulate at the damaged area forming an atheroma. Calcium salts and fibrous tissue accumulate at the atheroma, forming a hard plaque which narrows the artery lumen. The narrowing of the artery lumen causes even higher blood pressure. If the lumen of the artery is blocked in the coronary ~~arteries~~ arteries, the heart's supply of oxygen is prevented causing it to start respiring anaerobically. Complete blockage of the coronary arteries result in a heart attack. Therefore

a person's risk of having a heart attack is significantly increased if the person has high blood pressure – called hypertension.



### ResultsPlus Examiner Comments

This response gained credit for the following points for a maximum of four marks:

- damage to the endothelium of the arteries
- inflammatory response
- formation of atheroma
- narrowing of the lumen of the artery
- further rise of blood pressure.

This response scored one mark.

\*(iii) People in this category are more likely to develop high blood pressure than people with a healthy weight.

Explain why someone who has a high blood pressure is at a significantly higher risk of developing CVD. e.g. heart disease

(4)

Someone with high blood pressure is at a higher risk of developing CVD because the higher blood pressure means that there is more strain on the heart to pump blood further away and at an appropriate rate. The cardiac muscle therefore uses much more energy meaning that it can get worn out much easily. This <sup>de</sup>increases the likelihood of the cardiac muscle working <sup>off</sup> and could lead to a heart attack. People who have high blood pressure will most probably take in a lot of saturated fats, do little exercise <sup>and</sup> possibly be smoking. All

these factors are risk factors of developing CVD. The tobacco smoke narrows the artery or (coronary) artery and so increases CVD risk. Heart attack is caused by a blockage of the coronary artery. Saturated fats increase likelihood of CVD and saturated fats contain a lot of energy. Any excess ~~is~~ energy in the body is stored as fat.



**ResultsPlus**

**Examiner Comments**

This response is typical of those candidates who think that the key effect of high blood pressure is the direct strain and 'wearing out' of the heart, rather than atherosclerosis. The candidate gained one mark for the blocking of an artery.

This response gained one of the four marks available.

\*(iii) People in this category are more likely to develop high blood pressure than people with a healthy weight.

Explain why someone who has a high blood pressure is at a significantly higher risk of developing CVD.

(4)

The higher the blood pressure the greater the pressure in the arteries and heart. The faster the blood is moving as a result. The faster the blood is moving the greater the hypertension and greater the peripheral resistance between the arteries + blood. The higher the peripheral resistance the more likely the endothelium is to tear <sup>and</sup> the more likely an atheroma will form. The more atheromas that form the more likely the ~~body~~ body will develop CVD (stroke, heart-attacks etc.).



**ResultsPlus**

**Examiner Comments**

This response gains credit for recognising that atheromas could form as a result. They did not get the mark for the damage to the endothelium, a) because it is spelt incorrectly so is penalised for QWC for this question, and b) it is not clear that they are describing the inside of an artery as the site of the damage.



**ResultsPlus**

**Examiner Tip**

Make sure you pay careful attention to the spelling of key terms, particularly when a question is labelled as an opportunity to assess the quality of written communication.

## Question 5 (b)

Many candidates chose to approach this from the exercise point of view. However, there were a number who merely stated "exercise" without qualifying this with "increased" or "regular". Often candidates did not then go on to describe the change in the balance of the energy budget although many appreciated that this would reduce weight or reduce the risk of atherosclerosis.

Other candidates chose to focus on reduced saturated fats or cholesterol in their diets. Often, however, they then failed to make it clear that this would reduce the blood cholesterol (often stating that this would lower cholesterol in the body) but usually did then appreciate that this would reduce the risk of atherosclerosis.

Some candidates merely stated that a healthier diet would be beneficial without qualifying this with anything of credit, i.e. what would be a healthier diet and what effect it would have on obesity or the risk of CVD.

Some candidates did not respond to the context of the question and discussed eating less salt or the use of beta blockers to lower blood pressure which was not accepted for credit.

This response gains all three marks available.

(b) Suggest **one** piece of medical advice that could be given to someone who does not have high blood pressure but who is obese.

Explain why this will help to reduce their risk of developing CVD.

(3)

Medical advice: <sup>Eat</sup> ~~Eat~~ for more foods with vitamins C and E

Why this will reduce the risk of developing CVD: Foods with vitamins E + C are antioxidants so they provide hydrogen which can bond with any free radicals ( $O_2^{\cdot}$ ) to prevent them from damaging the epithelial layer in ~~the~~ <sup>the</sup> arteries hence reducing the risk of developing CVD.



**ResultsPlus**  
Examiner Comments

This response gains credit for providing a specific change to the diet and a clear explanation about how this will lower the risk of CVD - antioxidants and therefore reduce free radical damage.

This response gained no marks.

- (b) Suggest **one** piece of medical advice that could be given to someone who does not have high blood pressure but who is obese.

Explain why this will help to reduce their risk of developing CVD.

(3)

Medical advice: *A reduction in salt foods with high salt content.*

Why this will reduce the risk of developing CVD: *salt makes the kidneys retain<sup>water</sup> in turn this means there is more blood plasma in the blood, increasing the blood pressure, as there is there is an extra strain in blood vessel.*



**ResultsPlus**

**Examiner Comments**

This response focuses on the reduction of salt and therefore blood pressure. The reason they have received no marks is that they have not addressed the context of the question which is obesity and specifically not high blood pressure.



**ResultsPlus**

**Examiner Tip**

Always read the context of the question carefully.

### Question 5 (c)

Over 70% of candidates correctly identified that Finland, UK and Italy showed a decrease and that Poland experienced an increase. However, a number of candidates failed to make this clear by giving separate accounts of each country with quoted figures and so was too disjointed to be awarded the overall trend mark.

Many candidates approached this question as if it had asked them to describe the trends and not discuss the statement with many manipulating the data, sometimes giving exhaustive accounts and calculations to compare the countries.

Some candidates appreciated the limitations of the data, often with respect to the fact that only males were studied and occasionally that the number of countries or timescale involved in the study was limited. This allowed these candidates to often score the maximum three marks (only 9%), but most (over 60%) gained only two marks.

This response gains all three marks available.

Using the information in the graph, discuss the statement that death rates from CVD are falling.

Death rates ~~are~~ <sup>were</sup> falling from 1975 to 1995 <sup>(3)</sup> in Italy, UK and Finland. For example in Finland death rates more than halved. However death rates grew in Poland from 1970 to 1990 and fell slightly from 1990 to 1995. So death rates only fell significantly in 3 of the 4 countries. Also the graph only shows results up to 1995 so we can not say that death rates from CVD are falling currently. Also the graph only shows the results for men, not for women.

(Total for Question 5 = 12 marks)



**ResultsPlus**  
Examiner Comments

The candidate has correctly described the trend for the three identified countries and the different trend with Poland. They have also recognised that the data is limited for timescale and gender.

This response gained two of the three available marks.

Using the information in the graph, discuss the statement that death rates from CVD are falling.

(3)

In most cases the statement is supported as Finland, UK and Italy all have falling death rates from CVD. For example, the UK goes from 500 deaths per 100000 to 300 so it has decreased 200 deaths per 100000. However, Poland increases in 1975-1980 by 60 deaths per 100000 people which contradicts the statement.



**ResultsPlus**  
Examiner Comments

The majority of responses were like this, gaining marks for the general trend done for all countries except Poland and recognising that the death rate in Poland had increased. Apart from recognising the exception of Poland there is no other discussion about the potential limitations of the data presented.

This response gained one of the three available marks.

Using the information in the graph, discuss the statement that death rates from CVD are falling.

(3)

With the exception of Poland, all the countries in the graph shows a net decrease in death rate of males. Finland shows the greatest change from 700 deaths per 1000 to 370 deaths per 1000. Italy shows the smallest decrease from 220 deaths per 1000 to 120 deaths per 1000.



**ResultsPlus**

**Examiner Comments**

The candidate was given credit for the overall trend for all countries except Poland, but they failed to state that the death rate had increased for Poland or recognised any other limitations in the data for justifying the statement.



**ResultsPlus**

**Examiner Tip**

When discussing a statement related to data, consider what the potential limits of the data are - does the statement relate only to the data presented?

## Question 6 (a)

This question gained a full spread of marks with similar numbers scoring 0, 1, 2 or 3 marks.

Many candidates appreciated that folding of the primary structure or the formation of the secondary and tertiary structures was relevant to bring the amino acids closer together. Correct mention of the bonds involved in this process was often seen. However, this was occasionally penalised with the mention of peptide bonds between the relevant two amino acids.

Only approximately 20% of candidates appreciated and described the idea of bonding between R groups. This meant that most candidates effectively limited themselves to a maximum of two marks.

A significant number of candidates approached this question from the point of view that a change in the amino acid sequence was brought about by deletion, substitution or hydrolysis (by mutation or genetic engineering), so bringing the amino acids closer together. This gained no credit.

This response gained all three available marks.

**6** Lysozyme is an enzyme found in tears. Lysozyme can destroy some bacteria by breaking down the polysaccharide chains that form part of their cell walls.

(a) The primary structure of lysozyme is a specific sequence of 129 amino acids.

Two of the amino acids that make up the active site are in positions 35 and 52 in the primary structure.

Suggest how these two amino acids could be brought closer together to form part of the active site of this enzyme.

(3)

Folding of the primary structure, the sequence of amino acids, held by hydrogen bonds <sup>can</sup> cause the two amino acids to be brought closer together. Further interaction of the R groups for example formation of ionic bonds and disulphide bridges can cause the two amino acids to be brought <sup>even</sup> closer together.



**ResultsPlus**  
Examiner Comments

Credit was given for:

- recognition of the folding of the primary structure
- naming bonds involved
- recognising that bonds form between the R groups of the amino acids.

This response failed to score any marks.

6 Lysozyme is an enzyme found in tears. Lysozyme can destroy some bacteria by breaking down the polysaccharide chains that form part of their cell walls.

(a) The primary structure of lysozyme is a specific sequence of 129 amino acids.

Two of the amino acids that make up the active site are in positions 35 and 52 in the primary structure.

Suggest how these two amino acids could be brought closer together to form part of the active site of this enzyme.

(3)

A mutation could occur, meaning that insertion of amino acid at position 35 moved to 51, so that it's next to 52. ~~Or~~ As the lysozyme folds into a secondary structure, they may be brought closer together, being able to form peptide bonds in a condensation reaction.



**ResultsPlus**  
Examiner Comments

This is an example of the common error of thinking that a mutation (or genetic engineering) would be the cause of bringing the amino acids close together in the final structure of the enzyme.

## Question 6 (b) (i)

It was very disappointing to see that so many candidates did not read the question carefully and answer the question asked.

Almost all candidates correctly described the nature of the positive correlation shown by the data, so gaining the first mark point. However, for most candidates this was the maximum mark achieved. Most candidates approached this from a describe and manipulate the data point of view and gave lengthy descriptions and calculations of the data. This was because the word "explain" within the rubric of the question was overlooked and most candidates merely described the data.

Some candidates did attempt to discuss the facts that there would be more active sites available, that there would be more collisions between enzyme and substrate or that there would be no enzyme-substrate complexes formed. Some recognised that enzymes lower activation energies and that in this context the enzyme concentration was the limiting factor, or that the substrate concentration must have been in excess when calculating the initial rate.

This response gained all three available marks.

- (i) Using the information in the graph, explain the effect of the concentration of lysozyme on the initial rate of destruction of bacteria.

(3)

As the concentration of lysozyme increased, so did the initial rate of bacteria destruction (e.g. at  $0.1 \text{ g dm}^{-3}$  only 1.8 arbitrary units, at  $0.4 \text{ g dm}^{-3}$  8 arbitrary units. This is an increase of 6.2 arbitrary units.) This is because lysozymes are enzymes, which are biological catalysts that lower the activation energy of a reaction to occur. As the concentration of lysozyme increased, there were more active sites for the bacteria to bind to, so ~~they~~ <sup>more bacteria</sup> are broken ~~down~~ down in a given time as more enzyme-substrate complex formed, that put pressure on the bonds in the bacteria so they <sup>were</sup> destroyed.



## ResultsPlus

Examiner Comments

Credit was given to this response, for the maximum of three marks, for:

- recognition that the enzyme increases the rate of reaction;
- enzymes lower the activation energy required for the reaction;
- the higher concentration of enzymes means there are more active sites available;
- more enzyme substrate complexes can be formed.

This response gained just one mark.

(i) Using the information in the graph, explain the effect of the concentration of lysozyme on the initial rate of destruction of bacteria.

(3)

There is positive correlation between the concentration of lysozyme and the initial rate of destruction of bacteria. As the concentration is increased, the initial rate of destruction also increases. Example: Concentration increased from 0.1 to 0.2 - rate of destruction increases from 1.9 to 4 arbitrary units



**ResultsPlus**

**Examiner Comments**

This response is a typical example of the many responses that gained one mark for recognising that the enzyme caused an increase in the rate of destruction of the bacteria in a description of the data instead of an explanation of the effect asked for in the question.



**ResultsPlus**

**Examiner Tip**

Just because you are provided with data don't assume that the question is asking you to describe the data - particularly when the question asks you to **explain** the effect!

### Question 6 (b) (ii)

Many candidates stated correctly that the explanation was due to anomalies and so gained the mark. Others chose to appropriately describe inaccuracies in measuring or random errors. However, a significant number of candidates focussed on a description that it is a line of best fit, or just used the term outliers which gained no credit.

One mark for this response.

(ii) Suggest why some of the data points in the graph do not fit on a straight line. (1)

because they were anomalies.



**ResultsPlus**  
Examiner Comments

This is a typical example of the many correct responses to this question.

This response gained no marks.

(ii) Suggest why some of the data points in the graph do not fit on a straight line. (1)

This is because it is the line of best fit and is to show the average increase.



**ResultsPlus**  
Examiner Comments

This example is typical of those who failed to get the mark having concentrated on the line and not on why there may be variation in the results.

### Question 6 (c)

A common error here was the discussion that the enzyme would be denatured, rather than specifically mentioning the active site. Nevertheless, many then went on to correctly identify that the active site shape would change and this would prevent the formation of enzyme-substrate complexes. As a result over 50% of candidates gained the maximum two marks for this question.

This response gained both available marks.

(c) Temperature affects the activity of lysozyme.

Suggest why increasing the temperature above 45 °C causes a decrease in the activity of lysozyme.

(2)

45°C is the optimum temperature of the lysozyme. After 45°C the active site of the lysozyme denatures which means it cannot form enzyme substrate complex.



**ResultsPlus**  
Examiner Comments

This response clearly shows the effect on the enzymes active site and the reason this then decreases the activity of the enzyme.

This response gained no marks.

(c) Temperature affects the activity of lysozyme.

Suggest why increasing the temperature above 45 °C causes a decrease in the activity of lysozyme.

(2)

This would cause a decrease in activity due to the fact that enzymes can only work best at a temperature of 37°C or below otherwise anything above this temperature and the enzymes will denature and will not work. 37°C is an enzymes optimum temperature.

(Total for Question 6 = 9 marks)



**ResultsPlus**

**Examiner Comments**

This is a typical example of a response that did not go beyond a GCSE level response to include some AS level explanation of cause and effect that would have been relevant to this question.



**ResultsPlus**

**Examiner Tip**

Just stating that an enzyme is denatured is not sufficient information for AS level Biology in a topic that has been covering the structure and functioning of proteins.

This response gained no marks.

(c) Temperature affects the activity of lysozyme.

Suggest why increasing the temperature above 45 °C causes a decrease in the activity of lysozyme.

(2)

This is because it gets too hot as the temperature gets higher and loses energy.



**ResultsPlus**  
Examiner Comments

This candidate was clearly confused about the relationship between temperature and energy and made no reference to the enzyme itself.

## Question 7 (b)

Over 70% of candidates correctly identified nitrogen as the element present in all amino acids, but missing from carbohydrates. Where mistakes were made it tended to be for naming something that is not an element, e.g. R group, amino group of carboxylic acid group. N alone was not accepted as an answer as this is not the name of the element.

7(a) These multiple choice questions caused few issues for most candidates with typically about 85% of candidates getting each item correct. The most frequent errors were for 7(a) (iv) with answers of triglyceride or water as the product of hydrolysis.

This gained the mark.

(b) Name **one** element found in all molecules of **Q** that would not be found in carbohydrates.

(1)

nitrogen.



**ResultsPlus**  
Examiner Comments

An example of the typical correct response.

This response gained no marks.

(b) Name **one** element found in all molecules of **Q** that would not be found in carbohydrates.

(1)

A residual group (R)



**ResultsPlus**  
Examiner Comments

This was the most common incorrect answer. They have identified something present on an amino acid that is not present in a carbohydrate, but ignored the fact that the question asks them to name an element - an R group is not an element.

## Question 7 (c)

A common error here was the discussion that the enzyme would be denatured, rather than the active site. Nevertheless, many then went on to correctly identify that the active site shape would change and this would prevent the formation of enzyme-substrate complexes. As a result over 50% of candidates gained the maximum two marks for this question.

7c: Most candidates correctly included the presence of water as a result of the reaction.

Almost 40% of candidates also drew the correct glycosidic bond together with the remaining groups drawn correctly, giving them the maximum three marks.

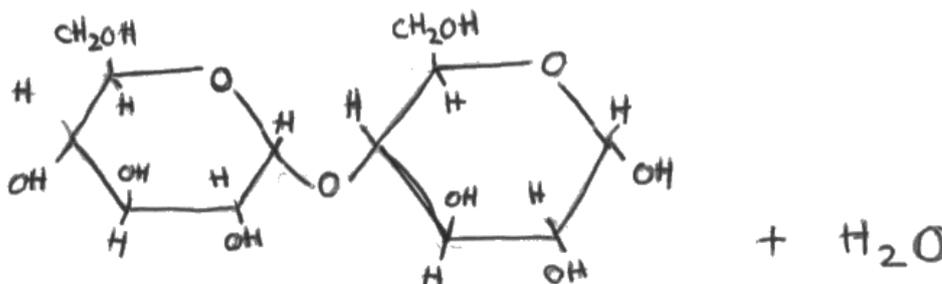
A common error was to omit the H on C5 or to fail to show the glycosidic bond correctly.

A few candidates did not try this question or chose to join the wrong molecules, e.g. amino acids despite being given a diagram of molecule R to copy and use.

This response gained all three marks.

(c) Draw a diagram to show the molecules produced when **two** molecules of **R** join together during a condensation reaction.

(3)



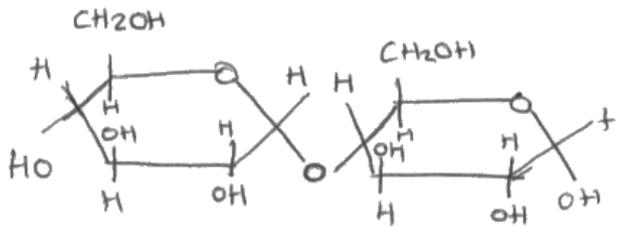
**ResultsPlus**  
Examiner Comments

This is a typical example of the many complete correct response we saw.

This response gained two of the available marks.

(c) Draw a diagram to show the molecules produced when **two** molecules of **R** join together during a condensation reaction.

(3)



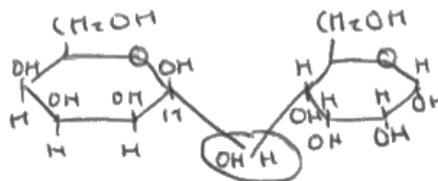
### ResultsPlus Examiner Comments

This candidate has drawn the disaccharide produced correctly, but unfortunately ignored the water that has been produced from the condensation reaction.

This response gained no marks.

(c) Draw a diagram to show the molecules produced when **two** molecules of **R** join together during a condensation reaction.

(3)



### ResultsPlus Examiner Comments

This candidate has not shown a glycosidic bond, they have ignored the production of water and have missed the hydrogens on the carbon 5 in each ring.

## Question 7 (d)

A significant number of candidates either failed to describe the dipole nature of water or did so inaccurately. Common answers referred to the positive and negative charges on the hydrogen and oxygen, which was incorrect. Others did identify that these were slight charges and so gained the mark. Others gave the idea that water can form hydrogen bonds.

However, many candidates identified an essential property of water, e.g. it is a good solvent or referred to its cohesive and adhesive or thermal properties. However, without the inclusion of an accurate description of the charges or hydrogen bonding this gave many candidates a maximum score of only one mark.

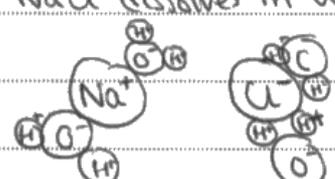
Some candidates, when describing the ability of water to dissolve and/or transport molecules they failed to qualify this with reference to ions and/or polar molecules (or suitable examples) and so failed to get the credit here, as not everything is soluble in water.

This response gained both available marks.

(d) Explain how the dipolar nature of water is essential for living organisms. (2)

dipolar  
oxygen is  $\ominus$  nature means water molecules form hydrogen bonds with themselves and other molecules with similar molecules. This means water can be used as a transport medium for all organisms e.g. NaCl dissolves in water

Also has high specific heat capacity and high latent heat of evaporation ~~so~~



(Total for Question 7 = 10 marks)



### ResultsPlus Examiner Comments

As well as describing how water can form hydrogen bonds, this candidate has gone on to give three good examples of the properties of water that make it essential for living organisms (solvent/transport medium, high specific heat capacity and high latent heat of evaporation). Only one of these examples would have been sufficient for the maximum mark.

This response gained one of the two marks available.

(d) Explain how the dipolar nature of water is essential for living organisms.

(2)

~~water~~ has a water molecule has a slightly positive end and a slightly negative end. The slightly positive end attracts to the slightly negative end of another water molecule forming a hydrogen bond resulting in strong intermolecular forces.



**ResultsPlus**

**Examiner Comments**

This is a good example of how the dipole nature of water provides hydrogen bonding, but does not go on to link this to a property of the water that is essential to life.

This response gained one of the available two marks.

(d) Explain how the dipolar nature of water is essential for living organisms.

(2)

So many ~~ions~~ <sup>Water</sup> ~~it~~ ~~are~~ therefore is a very good solvent. Ions dissolve in water, then they can get into the plant for growth. Also water help cells move all around the body. can carry substances



**ResultsPlus**

**Examiner Comments**

This response gives a good example of why water is essential, but has not linked this back to the dipole nature of water for the explanation.

This response gained no marks.

(d) Explain how the dipolar nature of water is essential for living organisms.

(2)

Water contains positive oxygen atom hydrogen atoms and negative oxygen atoms. It is essential because it allows substances to dissolve in water and be transported around mass systems such as bodies via the blood.



**ResultsPlus**  
Examiner Comments

This response was close to gaining credit. However, the atoms in water are not fully charged so this is not clear enough for the alternative for hydrogen bonding mark.

It is also too vague for the property mark as it has not given an example of a molecule or type of molecule that can dissolve in water as not everything is water soluble.



**ResultsPlus**  
Examiner Tip

At AS level try to be as clear and specific as possible as you may not get credit if your answer is open to too much interpretation - particularly if the interpretation can include possibilities that are wrong answers.

### Question 8 (a) (i)

It was disappointing that less than 25% of candidates managed to interpret this graph correctly to identify the point at which the bicuspid valve would close. The most common error was just stating the time where the peak pressure was found on the graph, to the end of the trace. Some candidates misread the scale of the axis and others identified the point where it would reopen.

This response gained the mark.

(a) Use the graph to identify the following.

(i) The time at which the bicuspid (left atrioventricular) valve closes. (1)

0.14 seconds



#### ResultsPlus Examiner Comments

This candidate correctly identified the time at which the bicuspid valve would close - when the pressure in the left ventricle first exceeds the pressure in the left atrium.

This response gained no marks.

(a) Use the graph to identify the following.

(i) The time at which the bicuspid (left atrioventricular) valve closes. (1)

0.3 seconds



#### ResultsPlus Examiner Comments

This is an example of the most common error when the candidate has identified the peak of ventricular systole as the time the bicuspid valve closes.



#### ResultsPlus Examiner Tip

Remember that valves open or close when the pressure one side first exceeds the pressure on the other side.

This response gained no marks.

(a) Use the graph to identify the following.

(i) The time at which the bicuspid (left atrioventricular) valve closes.

(1)

0.12 seconds



**ResultsPlus**

**Examiner Comments**

This response illustrates another error some candidates made. By not checking the scale carefully they have come up with the wrong value.



**ResultsPlus**

**Examiner Tip**

Check the axis carefully to make sure you do not make errors in reading values from graphs.

### Question 8 (a) (ii)

Although better than 8(a)(i), there were still only about 40% of candidates who were able to correctly identify the pressure when the semilunar valve would close. When the relevant point was identified some candidates misinterpreted the scale and a few quoted the time instead of the pressure (despite the units being included on the answer space).

This response gained the mark.

(ii) The pressure in the aorta when the semilunar (aortic) valve closes. (1)

~~10~~ 13.5 kPa



This is an example of the correct response.

This response gained no marks.

(ii) The pressure in the aorta when the semilunar (aortic) valve closes. (1)

17 kPa



This candidate has clearly recognised the correct point of the graph where the semilunar valve will close, but has misread the pressure scale so ended up with an incorrect value for the pressure.

This response did not get the mark.

(ii) The pressure in the aorta when the semilunar (aortic) valve closes. (1)

9  
~~14.5~~ kPa



This is an example of one of the common errors where they have just read off the pressure in the aorta at the end of the trace.

## Question 8 (b)

This was generally poorly attempted by many candidates. Despite the fact that the stem asked candidates to describe pressure changes, it was very disappointing that so many candidates failed to refer to any pressure change values in their answer. Equally, relatively few identified the stage of the cardiac cycle they were describing so any numerical values that were seen did not have a context for examiners to be able to award a mark. Candidates often explained what was happening in the cardiac cycle in detail including when the valves open and close without addressing what had been asked by the question.

Those candidates who did score some marks here usually gained the one for identifying the pressure decrease to zero during diastole. However, a number quoted the pressure of the atrium instead.

A low number of candidates approached the question correctly and accurately, scoring the three maximum marks.

Some candidates are clearly confused about cause and effect in the cardiac cycle in terms of the volume and pressure changes, with many thinking that the pressure falls during systole.

This response gained all three marks available.

(b) Using the information in the graph, describe the pressure changes that take place in the left ventricle during each stage of this cardiac cycle.

(3)

- During atrial systole, the pressure in the left ventricle (LV) is low at 0 kPa. At the end of atrial systole, the pressure is higher at 3.5 kPa.
- During ventricular systole, the pressure rises dramatically from 3.5 kPa to 14.5 kPa, a difference of 11 kPa.
- During diastole, the LV relaxes and the pressure falls from 14.5 kPa back down to 0 kPa as the LV is now empty.



**ResultsPlus**  
Examiner Comments

This candidate had clearly described the pressure changes in the ventricle at each clearly defined stage of the cardiac cycle.

This response gained no marks.

(b) Using the information in the graph, describe the pressure changes that take place in the left ventricle during each stage of this cardiac cycle.

(3)

In the first stage the atria are systolic so they are contracting but the ventricles are diastolic so they are relaxed so they have a low pressure. Once the pressure in the atria is sufficient the AV valves open and allow blood to flow in ventricles so in the ventricles the volume decrease as pressure increases, you can see this after 0.16 seconds from the graph. The pressure will increase until SL valves open and the blood is pumped out of the aorta. This happens after 0.3 seconds, so the pressure in the ventricles will decrease, because the blood is going through aorta.



**ResultsPlus**

**Examiner Comments**

This candidate has told the story of the cardiac cycle, but made no reference to the pressure change values on the graph that they were asked to describe in the question.



**ResultsPlus**

**Examiner Tip**

When asked to describe data make sure you make clear reference to the data values you are describing.

This response gained one of the three available marks.

(b) Using the information in the graph, describe the pressure changes that take place in the left ventricle during each stage of this cardiac cycle.

(3)

During atrial systole the pressure is increasing a little bit, then ~~decreases~~ as blood is ~~flowing~~ being pushed into the ventricle. Then during ventricular systole it peaks and reaches maximum pressure when blood is being forced out of the ventricle, then during complete diastole it decreases hugely back to 0, as the blood is ~~is being forced~~ completely out the ventricle in the aorta.



**ResultsPlus**

**Examiner Comments**

This response gained credit for describing the pressure drop to 0 during diastole. No pressure changes were described with suitable data from the graph for the other stages of the cardiac cycle.



**ResultsPlus**

**Examiner Tip**

When asked to describe data using information from the graph it is a good idea to use suitable values from the graph to illustrate your points.

This response gained no marks.

(b) Using the information in the graph, describe the pressure changes that take place in the left ventricle during each stage of this cardiac cycle.

(3)

During diastole, when the atrium are filling up with blood, the pressure change is relatively low at 0 kPa, however, once the AV valves open to release some of the blood built up in the atrium into the left ventricle, the pressure begins to increase (0 seconds - 0.3 seconds). Then, when the atrium contracts, (atrial systole) the pressure in the left ventricle increases to 14.5 kPa when it eventually contracts - ~~at~~ 0.13 seconds after atrial systole ventricular systole takes place - resulting in a gradual decrease in pressure (0.3 seconds - 0.6 seconds) until it has 0 kPa (diastole).



### ResultsPlus Examiner Comments

This candidate has confused what pressure changes are happening during the systole periods, e.g. they have stated that the pressure decreases to 0 during ventricular systole. This illustrates the confusion some candidates have regarding volume and pressure changes that occur during contraction of each chamber of the heart.

## Question 8 (c)

Unfortunately once again, many candidates merely gave an account of the cardiac cycle in detail with no regard to the pressure changes or the question asked. This showed a lack of attention to the rubric of the question, especially with respect to explaining rather than describing.

Those candidates who did approach this correctly usually explained the difference between the maximum pressures with respect to the relative distances needed to push the blood, so gaining two marks. Some also appreciated that the ventricular wall was more muscular to enable this to occur, and so gained three marks in total. However, many who did appreciate the importance of the chamber walls merely referred to their thicknesses without reference to the muscle.

Occasionally, candidates did manipulate the maximum pressure values of the atrium and ventricle and calculate the difference to gain another mark.

Other candidates recognised that the atrium must contract before the ventricle and described the effect of the bicuspid valve opening so that ventricular pressure increased during atrial systole.

A significant number of candidates think that the volume of the ventricle is significantly larger than the volume of the atrium.

This response gained all five marks available.

(c) During this cardiac cycle, the changes in pressure that occur in the left atrium and in the left ventricle are different.

Using the information in the graph and your own knowledge, explain these differences.

(5)

The left atrium contracts before the left ventricle, the atria ~~retract~~ contract at 0.14 seconds, whereas the ventricle contracts at 0.3 seconds. The atria contract before the ventricle because the atria push the blood into the ventricle ~~before~~ so it can fill with blood before it contracts. In addition the electrical signal from the pacemaker first activates the atria before the ~~ventricles~~, the signal reaches the ventricles. Atria have a much lower maximum pressure than the ventricle, this is because the atria only have to push the blood to the ventricle, so only need around 3.25 kPa to do so. However, the ~~ventricles~~ left ventricle pumps blood all

around the body, the blood needs to be at high pressure in order to reach all the extremities fast enough to allow high metabolic rate. The muscle on the ventricle walls is much thicker on the ventricle allows it to generate 14.5kPa, which is  $(14.5 - 3.25) = 11.25\text{kPa}$  more. (Total for Question 8 = 10 marks)



## ResultsPlus

### Examiner Comments

Full marks were earned by this response for the following points:

- the pressure increase happened in the atrium before the ventricle
- the maximum pressure is much lower in the atrium than the ventricle
- the distance the atrium has to push the blood is much shorter than the ventricle
- the muscle of the ventricle is much thicker than the atrium
- the difference in maximum pressures has been correctly calculated.

This response gained no marks.

\* (c) During this cardiac cycle, the changes in pressure that occur in the left atrium and in the left ventricle are different.

Using the information in the graph and your own knowledge, explain these differences.

(5)

They are different because the blood is in their sections at different times. For example after the ventricle releases all its pressure and its blood through the arteries the atrium begins

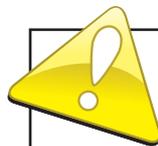
to fill back up again so at <sup>mis</sup> point  
the atrium is gaining pressure yet  
the ventricle has a little amount.  
Then when the ~~the~~ atrium contracts  
the pressure is shifted onto the ventricle  
and the atrium has little pressure.  
From the graph you can see that  
when the pressure of the left ventricle  
is at it's highest of 14.5 kpa the  
left atrium is at it's lowest  
pressure <sup>(0.5)</sup> because it just got rid of the  
pressure

(Total for Question 8 = 10 marks)



### ResultsPlus Examiner Comments

This is a typical example of an confused account of the events of the cardiac cycle many candidates wrote. There are no clear comparisons made between the pressure changes in the atrium and the ventricle and no explanation for the reason for those differences. The one pressure comparison made is at a point in time and does not describe what the pressure difference is.



### ResultsPlus Examiner Tip

Read the question carefully and make sure you know what the command word 'explain' means.

## 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. In particular make sure you make note of the command word used in the question so you are not tempted to describe data when asked to explain what is happening
- read your answers back carefully – do they answer the question, have you made at least as many clear points as marks available, and have you made any silly mistakes (e.g. does your answer make sense)
- when asked for the differences between two processes make sure your answer is comparative and mentions both things being compared
- when describing the measurement or control of variables, be specific about what is to be measured, e.g. volume or mass, and avoid vague terms such as amount
- pay particular attention to spelling, the use of technical names and terms, and organisation of your answer in QWC labelled extended writing questions
- use all of the information provided in the question to help you with your answer, e.g. diagrams, graphs and tables of data
- explore and assess examples of candidate responses from this report to help you understand what makes a good response to different types of question, and exemplify the level of knowledge and understanding expected at AS level.

## **Grade Boundaries**

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

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

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