

Examiners' Report  
June 2013

GCE Biology 6BI04 01

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## **Introduction**

Candidates clearly found some questions quite challenging, but it was encouraging that most of the questions were attempted by the candidates; very few blanks were seen. The multiple choice questions in question 1 caused problems for about half the candidates but the rest of the multiple choice questions caused very few problems. Candidates have clearly been trained for this paper using past mark schemes and some very good knowledge was demonstrated. Many candidates clearly find the specification points relating to the immunology very difficult, particularly differentiating between the role of the T helper cell and the T killer cell. Distinguishing between activation of T and B cells, their division into effector cells and their differentiation into memory cells and plasma cells, in the case of the B cells, is also causing problems to many.

## Question 1 (b)

Many candidates knew that mitosis was involved in the replication of these organisms, but less than half of candidates tried to extend their answer further to gain 2 marks.

(b) Explain how a colony of genetically-identical *Pleurococcus* cells could develop from a single original cell.

(2)

Through mitosis they could divide into two, this could keep being repeated to form a colony. Mitosis is cell division ~~where~~ where both cells formed have identical genetic material.



**ResultsPlus**  
Examiner Comments

This response illustrates all of our marking points, even though it is not completely accurate as mitosis is not cell division.



**ResultsPlus**  
Examiner Tip

Mitosis is nuclear division and not cell division.  
Cytokinesis is the correct term for cell division.

## Question 1 (c) (i)

About half the candidates scored two marks for this question.

- (i) Suggest how this 10 cm × 10 cm quadrat was used to obtain the percentage cover of *Pleurococcus* at each point. (2)

Each ~~square~~<sup>square</sup> represented 1%, the percentage cover was worked out by the following equation:  
$$\left( \frac{\text{Hits}}{\text{Area}} \times 100 \right)$$
  
Where the *Pleurococcus* was present, the square within the quadrat was counted as a hit. This made the test more valid, the higher the number of hits, the higher the percentage cover.  
↳ the more 'hits' present in a quadrat, the higher the percentage cover.



### ResultsPlus Examiner Comments

This response illustrates all our mark points clearly.



### ResultsPlus Examiner Tip

In questions like this, we quite often want you to describe the calculation that you would do using the data obtained.

- (i) Suggest how this 10 cm × 10 cm quadrat was used to obtain the percentage cover of *Pleurococcus* at each point.

(2)

The quadrat was ~~used~~ placed in 8 different areas, each area can be compared to ~~each~~ another in terms of percentage cover, light intensity and moisture content. The 10 cm x 10 cm allows a percentage cover to be measured and this can also be done by counting the squares and how many many pieces of of the species are found.



**ResultsPlus**  
Examiner Comments

Some candidates did start their response by describing practical detail. This response illustrates one of the most common mistakes that we saw for this question - a description of counting the number of *Pleurococcus* in each grid square, which would not work when trying to determine percentage cover.

### Question 1 (c) (iii)

Although all of our mark points were seen, very few candidates gave enough suggestions to score the full three marks; they focussed on one idea giving far too much unnecessary detail.

(iii) Suggest how more evidence for the relationship between light intensity and the distribution of *Pleurococcus* could be obtained.

(3)

Experiment could be done in a laboratory by keeping moisture content constant and ~~on~~ only changing light intensity. Other variable should be controlled such as temperature. More repeats and readings increases reliability.

More trees in different forests could also be measured.

A statistical test such as Spearman's rank could be used to test the relationship.



**ResultsPlus**

**Examiner Comments**

This is an example of one of the better responses that we saw for this question. It illustrates very clearly mark points 4, 5, 1 and 2 in that order.



**ResultsPlus**

**Examiner Tip**

If you see a 'suggest' question worth more than one mark, try to give as many suggestions as there are marks allocated to the question.

(iii) Suggest how more evidence for the relationship between light intensity and the distribution of *Pleurococcus* could be obtained.

← valid as they have been peer-reviewed (3)

By looking at ~~good~~ articles/journals which are trustworthy sources that where scientists have also carried out similar investigations to the experiment.

Also by carrying out more tests on perhaps different trees and working out the mean.

Or by taking sample of the *Pleurococcus* species into laboratory and only change one variable eg light ~~OR moisture~~ and keep all other variables constant and look at the effects this has on the species



**ResultsPlus**  
Examiner Comments

This is another example of a good response. This illustrates mark point 6, as well as 1 and 4.



(iii) Suggest how more evidence for the relationship between light intensity and the distribution of *Pleurococcus* could be obtained.

(3)

Use a statistical test to find the scientific significance of the results and compare them.

Repeat the experiment in a different location and see if the results are similar.



### ResultsPlus Examiner Comments

Although this candidate has tried to make more than one suggestion, the reference to using a statistics test is too vague as they are expected to know that a correlation statistics test would be used.



### ResultsPlus Examiner Tip

Always be as specific as you can - always read through your answers and ask yourself whether you could be any more precise in your answer.

### Question 1 (c) (iv)

This should have been a relatively straightforward question, but less than half the candidates scored two marks. Common mistakes included naming an abiotic factor, referring to herbivores as predators and not actually commenting on how the distribution of the *Pleurococcus* would be affected. We did loosen the mark scheme to include descriptions of the affect on numbers of the organisms as well.

(iv) Name **one** biotic factor and suggest how this factor might affect the distribution of *Pleurococcus* on the trees.

(2)

Biotic factor competition for light by other organisms

Effect other plants could leave the Pleurococcus in the shade, reducing the light it is exposed to, therefore reducing photosynthesis and reducing distribution of Pleurococcus.

(Total for Question 1 = 11 marks)



**ResultsPlus**  
Examiner Comments

Competition as the named biotic factor was common and usually linked to light or space. This is a good illustration of the type of response that we were hoping for.



**ResultsPlus**  
Examiner Tip

In a question like this where you are asked to describe the effect of something, you must give your answer some direction by saying it will go up or down (or whatever is appropriate) and not simply say that it will change.

(iv) Name **one** biotic factor and suggest how this factor might affect the distribution of *Pleurococcus* on the trees.

(2)

Biotic factor Disease

Effect This could destroy some of the Pleurococcus as it would cause death of the organisms that could not survive and therefore decrease the number of Pleurococcus present on trees in the area.

(Total for Question 1 = 11 marks)



**ResultsPlus**  
Examiner Comments

This is a good example of another possible pair of mark points.

(iv) Name **one** biotic factor and suggest how this factor might affect the distribution of *Pleurococcus* on the trees.

(2)

Biotic factor predation

Effect *Pleurococcus* may be a source of food for a species, so if there are more of these species, the distribution of *Pleurococcus* may be decreased.

(Total for Question 1 = 11 marks)



**ResultsPlus**

**Examiner Comments**

Reference to {predation / predators} was frequently made for a biotic factor. We did not penalise the candidates twice for this inappropriate term and awarded them a correct description of the affect.



**ResultsPlus**

**Examiner Tip**

Predators are animals that hunt other animals, not eat plants. You must use the correct terminology in your answer.

## Question 2 (a) (i)

This question did not score particularly well. There were two predominant reasons for this. Firstly, a lot of candidates did not pick up on the fact that the question was asking them to discuss the width of the leaf; we saw many answers in the context of the surface area. Secondly, explanations for the use of either the light or the carbon dioxide were too simple, just referring to their use in photosynthesis.

(i) The thin lamina

(2)

Allows maximum amount of light to reach chloroplasts, it allows higher concentration of  $\text{CO}_2$  to diffuse into chloroplasts. Both of these will increase the rate of photosynthesis.  $\text{CO}_2$  is needed for the calvin cycle to produce carbohydrates.



**ResultsPlus**  
Examiner Comments

This response illustrates all three of our mark points.



**ResultsPlus**  
Examiner Tip

Your answers must demonstrate {AS/A2} level knowledge. Simply stating that light or carbon dioxide is needed for photosynthesis is key stage 4 knowledge, you are expected to know details of the light-dependent and the light-independent reactions.

## Question 2 (a) (ii)

This question scored better than the previous one. Low level comments about the requirements for water resulted in many candidates not scoring full marks. Some candidates wrote about the phloem but often stated that glucose is transported which we could not allow. The explanations for the importance of the phloem rarely related to photosynthesis.

(ii) Vessels in the midrib (2)

The vessels provide the water needed for the photolysis in the light-dependent stage. The splitting of water results in ATP for the independent stage, which goes on to produce carbohydrates. Water splits into hydrogen (which reduces NADP) and ~~the~~ hydroxide (which produces ATP) both of which are needed in the calvin cycle.



**ResultsPlus**  
Examiner Comments

This response scored two marks for the very first statement. The extra detail was not necessary in this particular question.

(ii) Vessels in the midrib <sup>light</sup> to convert  $\text{CO}_2$  into carbohydrate<sub>(s)</sub>

- uptake of water from the roots to reach the photosynthesising cells on the leaf surface
- water is required to react with  $\text{CO}_2$  to photosynthesise producing carbohydrate/glucose



**ResultsPlus**  
Examiner Comments

This example is typical of the sort of explanations that we saw by candidates who failed to include {AS/A2} level knowledge.



**ResultsPlus**  
Examiner Tip

Try to include the level of knowledge that you have learnt over the last two years, so that your answers are more detailed than you could have given at GCSE.

## Question 2 (b) (i)

This question caused few problems, with nearly three quarters of the candidates scoring all three marks. We had expected to see several references to stoma, but were pleasantly surprised not to. The most common mistakes were thylakoid space for reaction R and cytoplasm for reaction T.

## Question 2 (b) (iv)

(iv) Suggest how GALP, formed by reaction T, can be used to synthesise the cellulose in plant cell walls. (4)

GALP formed from the reduction of GP can be used to synthesise glucose. 2 GALPs are used to synthesise glucose.  $\beta$ -glucose is used to form cellulose. These  $\beta$ -glucose join using 1,4 glycosidic bonds, via a condensation reaction, to form unbranched polymer chains of cellulose in plant cell walls.



### ResultsPlus Examiner Comments

This is an example of an excellent response, demonstrating all our mark points very clearly.



### ResultsPlus Examiner Tip

Remember that unit 4 is synoptic with both AS units. Sometimes you will be expected to write an answer that includes both AS and A2 knowledge.



(iv) Suggest how GALP, formed by reaction T, can be used to synthesise the cellulose in plant cell walls.

(4)

- GALP is used to form essential components of the cellulose cell wall.
- Allows for the synthesis of glucose.
- Cellulose is made up of 1-4 glycosidic bonds between glucose molecules.
- The bonds are straight/unbranched.
- Increased GALP production means in the Calvin cycle allows more glucose to be created for the plant cell wall.

(Total for Question 2 = 13 marks)



### ResultsPlus Examiner Comments

This response is nowhere near as good but still manages to pick up three marks, just. This response does demonstrate a common error that was made; candidates described the structure of cellulose and not its synthesis. Our mark scheme was written so that certain points could only be awarded if the description was of cellulose synthesis (mark points 1, 3 and 5).



### ResultsPlus Examiner Tip

You must read the question carefully - do not word spot and assume what you are expected to write about.

### Question 3 (b)

This question generated a range of responses that included all our mark points. The error that cost the most students marks was referring to carbon when it should have been carbon dioxide (mark point 1, 3 - 8) and referring to carbon dioxide when it should have been carbon (mark point 2). This was a QWC question and we were looking particularly for clarity of expression.

\*(b) Large areas of land may need to be cleared in order to produce biofuels. This might involve deforestation.

Discuss why the production of biofuels may not be carbon neutral.

(5)

Biofuels are considered carbon neutral because on combustion they release the same amount of  $\text{CO}_2$  as they did take in during photosynthesis when the plants were growing. However, forests are net absorbers of  $\text{CO}_2$  as they take it in during photosynthesis, they are considered carbon sinks. Deforestation means a net release of  $\text{CO}_2$  as the carbon stored in trees biomass organic material is burnt and released. This also decreases the amount of photosynthesis. Machines that are used for deforestation, planting biofuels and transporting them will also release  $\text{CO}_2$  in burning fossil fuels. Production of biofuels therefore is a net release of  $\text{CO}_2$ .



#### ResultsPlus Examiner Comments

This was a very good response that illustrates many of our mark points clearly. The marks given were 8, 1, 2, 3, 5 and 7, in that order



#### ResultsPlus Examiner Tip

It is always a good idea to give more facts than there are marks available.

\*(b) Large areas of land may need to be cleared in order to produce biofuels. This might involve deforestation.

Discuss why the production of biofuels may not be carbon neutral.

(5)

By clearing forest in order to grow biofuels, much less  $\text{CO}_2$  will be soaked up from the atmosphere by photosynthesis of plants. These carbon sinks will be removed and therefore although biofuels may be carbon neutral in their own sense that they do not change the concentration of  $\text{CO}_2$  individually, the net effect of deforestation in the area will be an increase in  $\text{CO}_2$ . Also the machinery used to clear land will produce  $\text{CO}_2$  from fuel combustion and the wood created from deforestation may in turn be used as fuel, creating more  $\text{CO}_2$ . The planting and transport of seeds from crops and the harvesting of crops may also produce more  $\text{CO}_2$ . The process of synthesising biofuels from crops, especially fermentation, will create  $\text{CO}_2$ .



**ResultsPlus**  
Examiner Comments

Another very clear response that was awarded mark points 4, 2, 3, 7 and 5, in that order.

\*(b) Large areas of land may need to be cleared in order to produce biofuels. This might involve deforestation.

Discuss why the production of biofuels may not be carbon neutral.

(5)  
Forests are a large natural carbon sink and therefore they remove large amounts of carbon from the atmosphere through photosynthesis. If deforestation happens, carbon stored in the trees will be released back into the atmosphere. Although biofuels are carbon neutral (produce the same amount of ~~oxygen~~<sup>carbon</sup> when burning and respiring), deforestation will increase carbon levels in the atmosphere which means ~~it is not~~ the production may not be carbon neutral. Trees will not be able to continue removing carbon dioxide from the atmosphere.



**ResultsPlus**

**Examiner Comments**

Although this candidate understood the gist of the question, their inaccurate expression cost them marks. We awarded mark point 2 on the first line, but could not award anything else. Their definition of carbon neutral is incorrect and it is carbon dioxide that is released into the atmosphere on burning. For mark point 4 to be awarded we wanted a link to photosynthesis.



**ResultsPlus**

**Examiner Tip**

Remember on questions about the carbon cycle e.g. deforestation and decomposition to specify what form the carbon is in.

(b) Large areas of land may need to be cleared in order to produce biofuels. This might involve deforestation.

Discuss why the production of biofuels may not be carbon neutral.

(5)

If deforestation takes place to produce biofuels, less  $\text{CO}_2$  will be taken up due to the reduction in plants and trees but  $\text{CO}_2$  will still be released when the biofuels are used. To be carbon neutral in the production and use of them there can't be a net increase in  $\text{CO}_2$ , there will be no net increase, but some biofuels may provide an increase. The machinery used to clear space for biofuel production will produce  $\text{CO}_2$ .



**ResultsPlus**  
Examiner Comments

No reference to photosynthesis so cannot award mark point 4 and no reference to burning the biofuels so not mark point 8. The sentence on line 5 is very unclear so we applied a QWC penalty. No reference to machinery using fuels so not mark point 7.

### Question 3 (c)

The responses to this question were quite disappointing considering that questions on this spec point have been asked several times in the past. The majority of candidates scored two marks, despite the advice given in examiner's reports.

(c) Explain how the combustion products, from the burning of fuels, may lead to global warming.

(4)

- fuels such as oil and fossil fuels are carbon sinks
- burning them releases carbon dioxide into the air
- carbon dioxide is a greenhouse gas
- it traps heat in the earth's atmosphere (greenhouse effect)
- increasing the temperature of the earth
- therefore leading to global warming
- increase in greenhouse gases such as carbon dioxide and methane is associated with increasing global temperatures.

(Total for Question 3 = 10 marks)



**ResultsPlus**  
Examiner Comments

This response scores one mark (mark point one). The reference to 'heat' on line 4 is too vague for mark point 3 to be awarded and for mark point 6 a reference to the 'temperature of the earth increasing' is also too vague.



**ResultsPlus**  
Examiner Tip

Use past mark schemes to help you prepare for examinations. Your answers must match these mark schemes almost word for word and not simply be close approximations.



(c) Explain how the combustion products, from the burning of fuels, may lead to global warming.

(4)

Combustion leads to the emissions of greenhouse gases such as methane and  $\text{CO}_2$ . This creates a layer around the Earth whereby infrared radiation from the sun (light) is emitted, and is reflected off the Earth, however due to the gases present and ozone layer, ~~these~~ many become trapped and bound back to Earth, heating it further, thus causing global warming.

(Total for Question 3 = 10 marks)



### ResultsPlus Examiner Comments

This response exemplifies three common errors seen for this question.

Many candidates did not consider the context of the question carefully enough and churned out their rote learning of carbon dioxide and methane as being greenhouse gases. We could not award mark point 1 if the candidates said that burning fuels produced methane.

Incorrect formulae cannot be awarded.

There is still confusion at this level with the ozone layer, even though it is not even in the GCE specification.

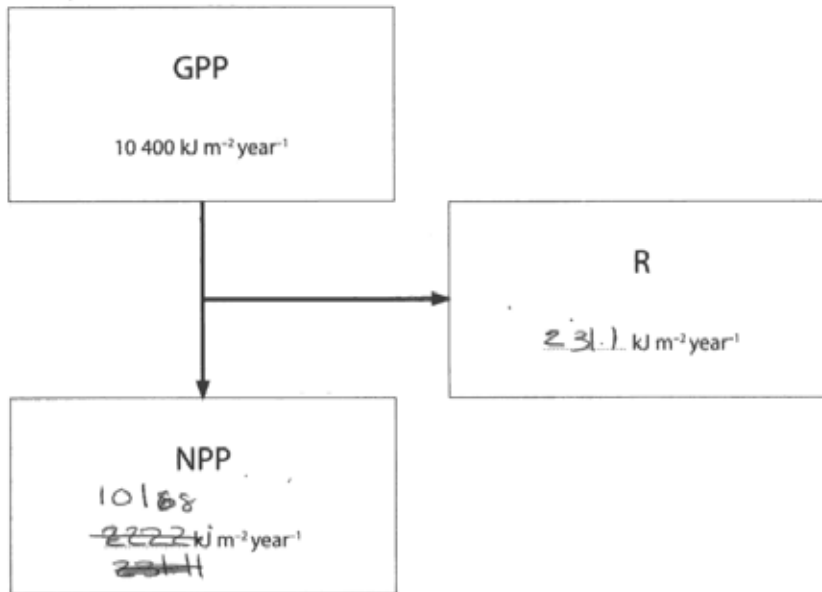


### ResultsPlus Examiner Tip

If you cannot use the correct formula for a chemical then do not use it!!

### Question 4 (a) (i)

A large majority of the candidates scored both the marks for this question. There were some careless errors in transferring answers from the 'working-out' area to the answer boxes.



(a) The efficiency of the transfer of energy from GPP to NPP for this grassland is 45%.

(i) Calculate the values for NPP and R. Write your answers in the diagram above.

(2)

$$\left( \frac{\text{Current}}{\text{Previous}} \right) \times 100$$

$$10400 \div 45 = \boxed{231.11} \text{ 45\%}$$

$$10400 - 231.11 = \frac{231.11}{10400} = 20.222$$

10168.



**ResultsPlus**  
Examiner Comments

There were some consequential error marks, but candidates still had to be mathematically correct and round their values {up / down} appropriately.



## Question 4 (a) (ii)

(ii) Using the information given, explain the relationship between GPP and NPP.

(3)

GPP is the rate at which energy is incorporated into a plant and NPP is the rate at which energy is stored as biomass. So therefore the greater the GPP, the more energy can be stored as biomass or NPP. The GPP NPP also depends on the amount of respiration as more energy is used for metabolic processes so there is less to be stored as biomass. The energy left over from respiration can be stored as biomass and plant tissue.  $NPP = GPP - R$ .



**ResultsPlus**  
Examiner Comments

This was one of the better responses. This scored three marks; mark points 5, 4 and 1, in that order.



**ResultsPlus**  
Examiner Tip

You must try and make at least as many statements as there are marks available for a question. Learn the equation for the relationship between GPP, NPP and R - then quote it in questions of this nature.

(ii) Using the information given, explain the relationship between GPP and NPP.

(3)

-  $NPP = GPP - R$

- NPP is the rate at which the photosynthetic products are locked into plant biomass in an ecosystem

- GPP is the rate at which energy is incorporated into a plant in the ecosystem

- much of this energy gets used by respiration and other reactions

- only certain percentage of it gets locked into plant biomass as growth.



**ResultsPlus**

**Examiner Comments**

There were a reasonable number of candidates that worded their answers poorly to imply that energy is 'used' for respiration. We know that energy is used for glycolysis but cannot accept this poor expression unless qualified. However, there is a mark in this type of question for stating an appropriate use of energy, that could be glycolysis or one that is more on spec such as active transport.

## Question 4 (b)

Two marks scored was common here, usually mark points 2 and 3. Few candidates started their answer at the beginning of the story by stating the obvious - mark point 1.

(b) Suggest why NPP values would be of use to a farmer who wanted to use this land for cattle.

(3)  
Because NPP shows the ~~growth~~ <sup>actual</sup> actual energy used by the plant, so if it is high it would be worth using the space for crops as it would be high energy crops which sell well, could also feed the cattle on the high energy ~~of~~ crop.



**ResultsPlus**  
Examiner Comments

A nice illustration of mark points 2, 5 and 1 in that order.

(b) Suggest why NPP values would be of use to a farmer who wanted to use this land for cattle.

(3)  
The farmer could find out the amount of NPP his grassland was producing so that he knows how much available energy there will be for cattle. so ~~the~~ the farmer would know how many cows to buy depending on available energy from the grass as grass is the cattle's main food source.



**ResultsPlus**  
Examiner Comments

Another good response that illustrates mark points 2, 3 and 1 in that order.

## Question 4 (c)

Mixed responses here with no particular trends to comment on.

(c) The units ( $\text{kJ m}^{-2} \text{year}^{-1}$ ) used in the diagram show a rate of energy production. Suggest why this is more useful than measurements of biomass in the grassland on a particular day.

Some days have longer hours of sun or higher light intensity than others. An average of the whole year creates an average of the seasons so that the days with more photosynthesis and those with less can be put together.

\* meaning GPP would be larger due to more photosynthesis  
(Total for Question 4 = 10 marks)



**ResultsPlus**  
Examiner Comments

Mark points 1 and 2 illustrated here.

## Question 5 (a)

The response to this question was absolutely astonishing with over half of the candidates being able to name the four bases correctly! We allowed phonetic spelling and the possibility that the candidate might be dyslexic, but there were still a huge number of responses that were simply incorrect for one or more of the bases.

(a) Name each of the bases represented by the letters, **A**, **C**, **G** and **T** in the diagram.

(1)

A Adanine

C Cytosine

G Guanine

T Thyamine



**ResultsPlus**  
Examiner Comments

This illustrates an example of an allowable phonetic spelling of adenine. However, we cannot allow '*thyamine*' as it is too close to the vitamin thiamine.

(a) Name each of the bases represented by the letters, **A**, **C**, **G** and **T** in the diagram.

(1)

A Anine

C Cytosine

G Guanine

T Thyosine



**ResultsPlus**  
Examiner Comments

Another example of incorrect versions of the names for the bases.

### Question 5 (b) (i)

The whole of this question illustrates quite nicely where candidates need to apply their knowledge to the context of the question, especially at A2.

(b) Using the sequence shown in the diagram, explain the meaning of each of the following terms.

(i) Triplet code

(2)

A sequence of 3 bases on the DNA codes for one amino acid on the DNA  
T T T codes for lysine



**ResultsPlus**  
Examiner Comments

This is an example of the response that we were hoping for: a definition of the term and then an illustration from the information given in the question.



**ResultsPlus**  
Examiner Tip

You must use the information given in the question to illustrate your answer where appropriate.

(b) Using the sequence shown in the diagram, explain the meaning of each of the following terms.

(i) Triplet code

(2)

Triplet code is a codon containing  
3 amino acids e.g. AAT for leucine



**ResultsPlus**  
Examiner Comments

Not an uncommon mistake illustrated here.

The most common mistake in the definition was to state that the base sequence 'made' the amino acid.



**ResultsPlus**  
Examiner Tip

Learn the definition of each Biological term used in the specifications, as you may be asked to state any of them in an exam paper.

### Question 5 (b) (ii)

Again, another illustration of where knowledge needs to be applied to a question. This definition did challenge their expression however.

(ii) Non-overlapping

Each triplet, or codon, can only code for one amino acid<sup>(2)</sup>. The code is read with respect to each codon, and does not overlap between adjacent codons. e.g. AAT = leucine but code cannot be read ATA or TAA. Each codon is distinct from its neighbouring codons.



**ResultsPlus**

**Examiner Comments**

At the end of this response, this candidate did score both marks.



**ResultsPlus**

**Examiner Tip**

When defining a word try to avoid using the word that you are trying to define in the definition.



### Question 5 (b) (iii)

A large proportion of the candidates understood the significance of a degenerative code, but could not actually describe its meaning unfortunately.

(iii) Degenerate

(2)

There are more triplet code combinations than amino acids. ~~One triplet~~ Amino acids can be coded for by more than one triplet code. AAT and AAC both code for leucine.



**ResultsPlus**  
Examiner Comments

A good example where a definition has been given and an illustration using the information in the question.

(iii) Degenerate

(2)

~~A codon~~ ~~Ami~~ ~~s~~ A triplet code codes for one amino acid. The code often contains more information than it needs. Usually the first two bases in a triplet code determine the amino acid, so if a mutation occurred the amino acid produced will not be affected.



**ResultsPlus**  
Examiner Comments

This is typical of many responses that we saw where candidates were trying to explain the significance of the degenerative code.

## Question 5 (d)

5d was another example where candidates tried to demonstrate knowledge without actually applying it to the context of the question - see comments for question 2biv. We really wanted the candidates to describe translation in the context of the DNA base sequence given in the question, not just reeling off everything they knew about the process of translation.

## Question 6 (a)

The candidates that read the question carefully did reasonably well in that they did not try to write comparisons that did not involve the nucleic acid. However very few scored more than one mark; it appeared that candidates had only been taught the structure of HIV and not viruses in general.

6 Human diseases can be caused by many different types of organism, such as bacteria and viruses.

(a) Give **two** differences between the genetic material of bacteria and viruses.

(2)

Bacteria has plasmids, viruses don't.

Bacteria has ~~two~~ circular DNA strands, viruses have linear strands (either DNA or RNA as genetic material)



**ResultsPlus**  
Examiner Comments

A good response where the candidate has tried to make more than the required two comparisons. We usually expect the candidates to make their two comparative statements within the same sentence, but as the candidates did struggle with this question we decided to piece their answers together.



**ResultsPlus**  
Examiner Tip

Always try to give one more comparison than the question asks.

### Question 6 (b) (i)

Not too many problems were encountered here, except by the candidates who simply repeated the question or who gave irrelevant information not relating to the process of phagocytosis itself.

(i) Describe how macrophages ingest the bacteria.

(2)

The macrophages engulf the bacteria through cytoplasm movement and endocytosis. This forms a vesicle containing the bacteria. Lysosomes containing digestive enzymes travel to the vesicle and fuse with its surface, releasing the enzymes into the vesicle and destroying the bacteria.



**ResultsPlus**  
Examiner Comments

This is an example of the type of response that we were looking for.



**ResultsPlus**  
Examiner Tip

Do not repeat the information given in the question in your answer.

### Question 6 (b) (ii)

A slightly more challenging question which again required the candidates not to repeat the information given in the question. Many just stated that the bacteria were inside the tubercles. There was also the expected confusion between antibiotics and antibodies.

(ii) Suggest why treatment with antibiotics may not be effective against the dormant bacteria in the tubercles.

(2)

Antibiotics may not be able to reach the bacteria as they are sealed in macrophages which have self antigen. Dormant bacteria contain waxy capsules which prevent antibiotic effect.



**ResultsPlus**  
Examiner Comments

This example illustrates marking points 1, 2 and 3, in that order.

(ii) Suggest why treatment with antibiotics may not be effective against the dormant bacteria in the tubercles.

- dormant bacteria is not detected by antibodies ; as they are not present in blood stream
- no antigens of bacteria are being expressed by bacteria
- dormant bacteria is inactive so antibiotic will not attack it at all.

vesicle releases the enzyme.



**ResultsPlus**  
Examiner Comments

This is very typical of the responses made by the weaker cohort of candidates.

### Question 6 (b) (iii)

Candidates made a good attempt at answering this question, but only a small percentage scored full marks. A large percentage described artificial passive immunity. Many wrote clumsy descriptions that were just not accurate enough to award marks at A2. Some churned out past mark schemes that did not quite answer the question.

(iii) TB can be prevented by vaccination. Explain how a person can develop artificial active immunity following vaccination.

(3)

Vaccination injects an inactive form of the antigen. The inactive form presents an antigen to a macrophage ~~which~~ engulfs it and becomes an APC. This activates T helper cells <sup>(clonal selection)</sup>, which release cytokines and activates the B cells, which produce antibodies and clone into B memory cells. So in a ~~secondary~~ secondary injection the ~~memory~~ antibody production



**ResultsPlus**

**Examiner Comments**

A good response that could be awarded mark points 1, 3, 4 and 6 in that order.

(iii) TB can be prevented by vaccination. Explain how a person can develop artificial active immunity following vaccination.

(3)

The person is injected with a weakened version of TB, so the person's B memory cells can identify the pathogen and produce antibodies corresponding to its surface proteins, then differentiate into the blood. The next time the person has TB, the antibodies are released rapidly, and the TB is eliminated.



**ResultsPlus**  
Examiner Comments

This could not be awarded any marks. We cannot award wrong biology - a vaccination does not contain TB - this is the name of the disease and not the bacterium. This was a very common mistake that prevented us awarding the first mark point. The reference to B memory cells is in the wrong context for this question.



**ResultsPlus**  
Examiner Tip

Although we really want you to use past mark schemes in your preparation for the examinations, we need you to apply them to the context of the question and not just repeat them verbatim to any question on that particular topic.

## Question 6 (c)

This question saw a range of responses and discriminated well; the weaker candidates struggled and the better candidates scored well.

- (c) In a person with TB, the dormant bacteria in tubercles may be activated after several years. The bacteria multiply rapidly, resulting in severe lung damage.

The bacteria are released from the tubercles. These bacteria can inhibit the activity of T cells and infect other organs.

Explain why the activity of these bacteria and the inhibition of T cells means that a person may quickly develop severe symptoms leading to death.

(4)

The bacteria are in vast numbers ~~so~~ so they can outnumber T cells\*. They cause lung damage which could be fatal as the person is unable to breath properly. They are able to infect other organs ~~th~~ preventing them from functioning properly and leading to death (i.e heart) \* and produce symptoms.

Inhibiting T cells means that T killer cells won't be activated by ~~the~~ cytokines from the T helper cell so the ~~to~~ infected cells cannot be killed. ~~A~~ B lymphocytes will ~~also~~ be unable to differentiate into plasma cells and release antibodies to kill the bacteria. This may give rise to opportunistic diseases which will be able to infect the body and produce symptoms because the immune system is ~~the~~ weakened.

(Total for Question 6 = 13 marks)



### ResultsPlus Examiner Comments

This is an example of one of the good responses that we saw. Mark points 1, 3, 5, 6, 7, 8, and 4 were all awarded, in that order.



(c) In a person with TB, the dormant bacteria in tubercles may be activated after several years. The bacteria multiply rapidly, resulting in severe lung damage.

activated, diffuse  
into plasma  
cells, and secrete  
antibodies making  
the bacteria for  
destruction.  
Active  
immunity  
make your  
own  
(4) antibodies

The bacteria are released from the tubercles. These bacteria can inhibit the activity of T cells and infect other organs.

Explain why the activity of these bacteria and the inhibition of T cells means that a person may quickly develop severe symptoms leading to death.

The inhibition of T cells means that B cells and T killer cells are not activated so the immune response is weakened or stopped allowing other pathogens to enter causing illness. When the bacteria multiply they destroy lung tissue decreasing surface area. This causes shortness of breath and bloody sputum. The bacteria may also go on to affect lymph nodes causing the lymph glands in the neck to swell which is a symptom of TB. The presence of bacteria will cause damaged cells to release chemicals to make the core body temperatures to rise causing a fever. This is meant to destroy and slow down bacteria and make the immune system more effective.

(Total for Question 6 = 13 marks)



### ResultsPlus Examiner Comments

Mark points 5, 4 and 8 were awarded on the first couple of lines. Mark point 1 could not be awarded as the candidate did not refer to 'further' damage or 'severe' breathing problems being caused. For mark point 2 we wanted to know how the bacteria travel round the body to the other organs.



### ResultsPlus Examiner Tip

Read the question very carefully and then apply your knowledge to the question being asked.

## Question 7 (a) (i)

Most students identified that this question required them to think about the role of the skin in preventing infection. Most identified that the skin was a barrier and that keratin was important. Some candidates wrote about the secretions killing the viruses, which we could not accept.

(a) Common cold viruses infect only the cells inside the nose.

(i) Suggest why common cold viruses cannot infect cells if they land on unbroken skin.

(2)

- They are unable to reach cell membrane
- unbroken skin surface has an impenetrable Keratin layer
- They die due to competition with skin flora bacteria on surface (for oxygen/space etc)
- They can't enter the blood stream to release it's RNA; no contact with cells in blood stream



### ResultsPlus Examiner Comments

This response was awarded two marks. We could credit the correct points made about the keratin in the skin being an impenetrable barrier. We could ignore the idea that competition with skin flora could kill the viruses as this does not contradict the barrier ideas.



### ResultsPlus Examiner Tip

Read the question carefully and then think about the context of the question. Yes, the skin does have properties to kill microorganisms, but not viruses. Viruses are not alive and therefore cannot be killed.

(a) Common cold viruses infect only the cells inside the nose.

(i) Suggest why common cold viruses cannot infect cells if they land on unbroken skin.

(2)

- Unbroken skin forms a physical barrier to the virus.
- The virus cannot infect skin cells, and because they cannot get to the cells below the skin, they cannot infect.
- Skin cells do not have protein receptors, so there is nothing for the virus to attach to.



**ResultsPlus**  
Examiner Comments

This was one of the few responses where the candidate had identified that this question was synoptic within the unit and was also testing the specificity of viruses for host cells.

### Question 7 (a) (ii)

Very few candidates recognised that this question was testing the requirements of virus particles for receptors on specific host cells. Some did think about the defence mechanisms in the blood but got confused about which cells were phagocytes.

(ii) Suggest why common cold viruses cannot infect cells if they enter the blood through a cut in the skin. (2)

Cold viruses are specialised so they are unable to infect any cells other than those of upper respiratory tract. A cut would have inflammation due to histamines, so phagocytes would be present, able to engulf and destroy the virus before it reaches.



**ResultsPlus**  
Examiner Comments

This candidate identified that the question was testing them on the specificity of viruses for host cells but did not use specific A2 level knowledge to answer the question.



**ResultsPlus**  
Examiner Tip

You must include A2 level detail to score highly at this level.

(ii) Suggest why common cold viruses cannot infect cells if they enter the blood through a cut in the skin.

(2)

As the virus attaches to a specific protein receptor. The cells in blood would have different receptors which the cold virus would not be able to attach to.



**ResultsPlus**  
Examiner Comments

This response illustrates the type of response that we were looking for.

## Question 7 (b)

Very few candidates scored well in this question. It appeared from the responses that we saw that some candidates thought that HIV was the only type of virus that existed whereas others had clearly not used the information given to them in the stem of the question.

(b) Compare the action of the RNA in the common cold virus with that found in HIV.

(2)

RNA in common cold virus undergoes translation first whereas HIV RNA undergoes converts into DNA via reverse transcriptase enzyme. HIV DNA is then integrated into host cell DNA via enzyme Integrase, whereas common flu virus RNA does not do this. Both lead to the production of proteins.



**ResultsPlus**  
Examiner Comments

This was one of the few good answers that we saw, scoring two marks.



**ResultsPlus**  
Examiner Tip

Read all the information that you are given in the question. We do not include any information in the question that you are not going to need.

(b) Compare the action of the RNA in the common cold virus with that found in HIV.

(2)

The RNA in common cold can be read at the ribosome.

The RNA found in ~~DATA~~ HIV has to be converted to viral DNA by ~~a~~ reverse transcriptase and inserted into the nucleus before translation can occur.



**ResultsPlus**  
Examiner Comments

This response is much more typical of what we saw. Repetition of the question for the cold virus and a good comment about HIV.

### Question 7 (c) (i)

This question was also poorly answered. The majority of candidates wrote about reverse transcriptase and integrase. It was encouraging however how well this part of the spec is known and understood.

(c) At Stage C, three enzymes are formed.

(i) Suggest why two of these enzymes, S and T, are needed at Stage D.

(2)  
One enzyme is required for the creation of the viral RNA, the other enzyme is required for production of protein coat or capsid of the virus.



**ResultsPlus**  
Examiner Comments

This is an example of the type of response that we were after.



## Question 7 (c) (ii)

More candidates identified what they were being tested on in this question, but still scored poorly through lack of specificity.

(ii) Suggest how enzyme U might catalyse the breakdown of the host cell membrane at Stage E.

(3)

Enzyme U has a specific active site that binds to a molecule/protein on phospholipid bilayer of host cell (complementary shape). This causes lysis of the host cell releasing sub-viral content out of cell.



**ResultsPlus**  
Examiner Comments

This candidate identified what we were after but did not develop their answer far enough to score all three marks.



**ResultsPlus**  
Examiner Tip

Use the mark allocation to help you write sufficient detail in your answers.

(ii) Suggest how enzyme U might catalyse the breakdown of the host cell membrane at Stage E.

(3)

E.g. It could hydrolyse cause hydrolysis of cell membrane.

It could also catalyse the breakdown of proteins in the cell membrane. This causes the cell membrane to lose control of what goes in and out of cell causing cell to swell and burst. Also known as lysis



**ResultsPlus**  
Examiner Comments

Another response where the candidate identified what we were after, but did not develop their answer far enough

### Question 8 (a) (i)

A large number of candidates scored mark points 1 and 2 for this response. However only the top candidates tried to think what the third mark might be for and suggested a reason for infertile offspring being produced.

- (a) Although chiffchaffs and willow warblers are often found at the same time in the same woodlands, they do not interbreed.
- (i) Suggest why successful interbreeding between chiffchaffs and willow warblers would make some scientists doubt their classification as separate species.

(3)

The definition of a species is a group of similar organisms which can reproduce to produce fertile offspring. Both species fit this definition as they are similar in external appearance and can interbreed successfully. The fact that interbreed would mean that one ~~are~~ responding to each other's mating call and therefore are similar in behaviour.



**ResultsPlus**  
Examiner Comments

This example is typical of the many responses that we saw.

### Question 8 (a) (ii)

This question saw some very good responses; candidates have clearly seen the mark schemes from previous papers that tested this part of the spec.

(ii) Suggest reasons why the two species do not interbreed.

(3)

~~They're~~ They're reproductively isolated. They are not attracted by the other species' mating calls so do not respond to them. They may have incompatible genitalia. Their breeding seasons may not overlap.



**ResultsPlus**  
Examiner Comments

This response scored mark points 1, 3, 4 and 2 in that order.

## Question 8 (b)

Many candidates attempted this question well and some good responses were seen.

(b) Records show that very little change in the appearance of chiffchaffs and willow warblers has occurred during the last two hundred years.

Suggest why the rate of change in the appearance of these two species is relatively slow.

(3)

Both species live in the same habitat with the same biotic and abiotic factors, so have the same selection pressures. Very few mutations will occur so there will be little change in allele frequencies between the two species. The gene pools will therefore only change slightly, so changes in phenotype and appearance will be slow.



**ResultsPlus**  
Examiner Comments

This response scored mark points 1, 2, 3 and 6.

(b) Records show that very little change in the appearance of chiffchaffs and willow warblers has occurred during the last two hundred years.

Suggest why the rate of change in the appearance of these two species is relatively slow.

(3)

They live in the same place at the same time. There is no selection pressure to cause natural selection because they're so similar. They are not geographically/reproductively isolated, and so their characteristics remain the same and the gene pool remains very similar with only a few differences in their alleles.

(Total for Question 8 = 9 marks)

TOTAL FOR PAPER = 90 MARKS



**ResultsPlus**  
Examiner Comments

Mark points 1 and 6 were awarded for this response. The reference to 'no selection pressures' was a common mistake that was seen.

## Paper Summary

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

- learn the AS topics very thoroughly - particularly those that have an obvious overlap with the unit 4 topics
- read the question carefully and use the information that you are given - you need to use all the information somewhere in the question
- ensure that you know the difference between the T helper cell and the T killer cell
- ensure that you understand the steps involved in the development of memory cells and plasma cells
- if you are asked to define a term or describe a process using a particular example then make sure that you illustrate a generic answer with the example given - this was needed in question 5, where you had to refer to the strand of DNA used in the question
- think carefully about the names of chemicals and make sure that you name them appropriately - in this paper, stating carbon dioxide and not carbon in question 3
- remember that not all barrier mechanisms and non-specific defence mechanisms are effective against viruses, as they are not living organisms
- make sure that you are aware of the structure of viruses other than HIV and that you do not assume every virus has the same mode of action as HIV
- learn the difference between antibodies and antibiotics and always double check the question and your answer to make sure you are writing about the correct one.

## **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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