

Examiners' Report  
June 2016

GCE Biology 6BI04 01

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June 2016

Publications Code 6BI04\_01\_1606\_ER

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## **Introduction**

This paper is the penultimate one for the current specification and it was encouraging to see that many of the candidates are meeting the expectations of the paper. This paper allowed the majority of candidates to access most of the questions and demonstrate their knowledge. It also had a number of discriminating questions that spread the marks across the ability range. All our mark points were seen and there were very few blank responses. The multiple choice questions worked and some of these were discriminating too, especially 4cii and the group of questions in the first part of question 2.

## Question 1 (a)

We saw some very good descriptions of B cell activation.

Some candidates wrote about the activation of T helper cells and then only commented on the subsequent release of cytokines.

(a) Describe how a B cell is activated.

(3)

B cell becomes an antigen-presenting cell once its receptors bind with the antigen. T helper cell binds with the B cell with complementary receptors and releases cytokines which stimulates and activates the B cells.



**ResultsPlus**  
Examiner Comments

This is a very concise account of B cell activation.



**ResultsPlus**  
Examiner Tip

Activation of B cells, T helper cells and T killer cells involve similar principles but they each involve different modes of antigen presentation.

## Question 1 (b) (i)

The majority of candidates knew that mitosis was involved in the cloning of B cells

### Question 1 (b) (ii)

The responses to this question were disappointing as very few candidates could write detailed enough accounts of this core practical despite it being tested on many occasions in the past.

Even fewer could apply this practical to their A2 knowledge and we rarely saw mp 1.

- (ii) Suggest how a microscope slide could be prepared to observe cell division in B cells.

(3)

A sample of B cells from the blood of  
could be injected out and a ~~the~~ small volume  
of the sample placed on a microscope slide.  
~~Heat up the sample and add another~~  
~~slide on top~~ Heat up the sample and  
spread it onto the microscope slide and place  
another slide on top. Place it under a high <sup>resolution</sup> magnifi  
microscope. Identify the different stages of mitosis  
for example meta phase, ana phase, telophase.



**ResultsPlus**  
Examiner Comments

This response is one of the few that we saw where a candidate has really thought about the A2 context of the question although it was disappointing that the stain had not been named.

### Question 1 (c) (iii)

Many of our candidates could identify structure Q correctly.

(iii) Name structure Q.

(1)

Rough endoplasmic Reticulum



**ResultsPlus**  
Examiner Comments

Some of the candidates looked very carefully at the photograph and qualified their answer correctly, as this candidate did.

### Question 1 (c) (iv)

We saw mark points 1 and 2 frequently for the role of the RER in the production of antibodies. Some candidates also wrote about the transport of the antibody in the ER and the folding that takes place.

(iii) Name structure Q.

(1)

rough endoplasmic reticulum (rough ER)

(iv) Describe the role of structure Q in the production of antibodies.

(3)

Structure Q, the rough ER is a membrane bound organelle located just outside the nucleus. It has ribosomes on it allowing mRNA from the nucleus <sup>(after transcription)</sup> of the plasma cell to the ribosome which is the site of translation (of the protein synthesis) so tRNA can bring complementary amino acids (from the cytoplasm) to the ribosome and attach to the codon so peptide bonds between amino acids can form making polypeptides for antibodies.

(Total for Question 1 = 13 marks)



**ResultsPlus**  
Examiner Comments

This response demonstrates the first two mark points but then goes into too much detail about translation which is going beyond the role of the endoplasmic reticulum.

When we produced the paper we knew that some candidates would mis-identify structure Q. In order not to penalise these candidates the three marks for this part of the question, we had alternative mark schemes that allowed them to write about the role of the structure that they had identified Q to be.

(iii) Name structure Q.

(1)

Golgi apparatus

(iv) Describe the role of structure Q in the production of antibodies.

(3)

Antibodies are constructed at ribosome during translation. Composed of polypeptide chain of amino acids. Once it has left the ribosome / RER it enters the golgi apparatus where it is modified further. Other chains are added, fats & acids, to give it its final structure. <sup>The antibody is</sup> It is then packaged in a transport vesicle and transported out of cell by exocytosis where the transport vesicle membrane binds with membrane of the cell and releases the antibodies.

(Total for Question 1 = 13 marks)



**ResultsPlus**  
Examiner Comments

This is one example where Q was mis-identified but the candidate still scored three marks for part (iv).



**ResultsPlus**  
Examiner Tip

Remember that both A2 papers can test you on any aspect of the AS specification so make sure that you revise all specification points.

## Question 2 (b) (i)

A comment about the overlapping error bars was frequently seen, but only a relatively few candidates made two suggestions.

Not many of the candidates appreciated that the error bars for the zero point were large in relation to the magnitude of the mean value.

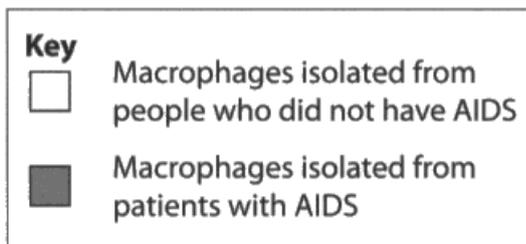
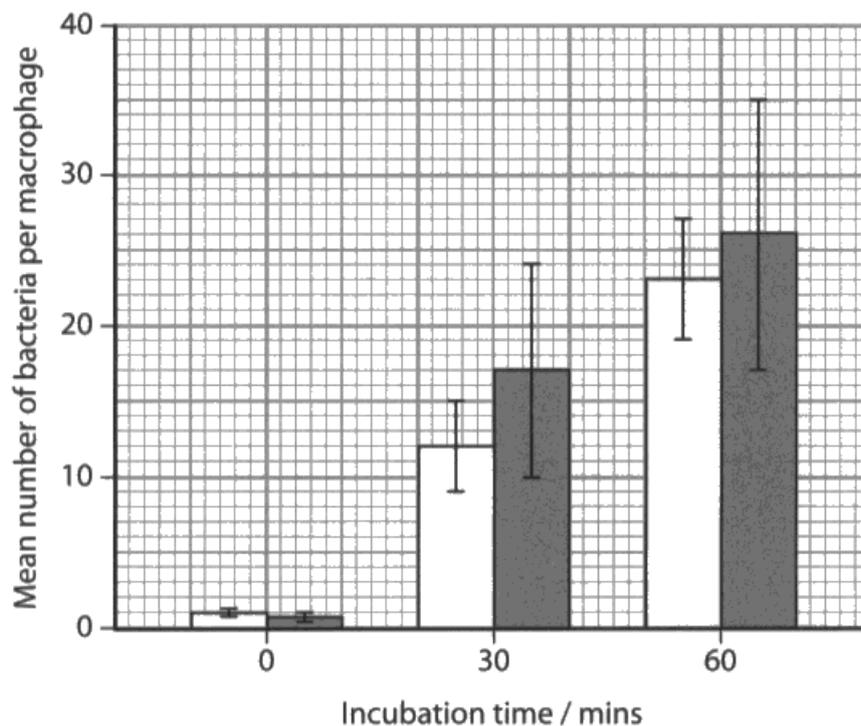
(b) Phagocytosis by macrophages is a non-specific response to infection.

The ability of macrophages to carry out phagocytosis of bacteria was investigated.

Macrophages from patients with AIDS were compared with macrophages from people who did not have AIDS.

These macrophages were obtained from the lungs of the individuals and incubated with bacteria for 60 minutes. The mean number of bacteria per macrophage was recorded at the start of the incubation period, after 30 minutes and after 60 minutes.

The results of this investigation are shown in the graph below.



- (i) It was concluded that there was no significant difference in the ability of these macrophages to carry out phagocytosis.

Using the information in the graph, suggest why this conclusion was made.

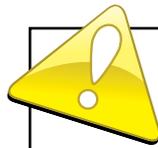
(2)

Because the error bars for both groups overlap.  
The difference ~~of~~ of mean number between two groups is very small ~~(the bar)~~. The highest difference value is 5.1



**ResultsPlus**  
Examiner Comments

One of the better responses seen.



**ResultsPlus**  
Examiner Tip

If there are two marks available for a suggest question then you need to make at least two suggestions to get both marks.

### Question 2 (b) (ii)

We saw many disappointing responses to this question. Too many candidates wrote responses whereby they recalled everything they knew about phagocytosis and lysosomes instead of answering the question asked.

- (ii) Using the fluid mosaic model of cell membranes, explain how a macrophage carries out phagocytosis of bacteria.

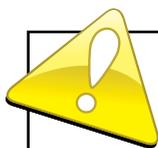
(4)

Macrophage is a type of white blood cell, phagocytosis is a non-specific response. Phagocytosis is the process of engulfing the bacteria, not allowing it to bind with any cells. Then lysosome, a digestive enzyme enters and breaks down the bacteria, getting rid of it. This ensures bacteria doesn't infect any host cells.



**ResultsPlus**  
Examiner Comments

This candidate's response is typical of many that we saw.



**ResultsPlus**  
Examiner Tip

Read the question carefully and think about what you are being asked to write about. Don't pick out key terms and then write everything that you know about them.

(ii) Using the fluid mosaic model of cell membranes, explain how a macrophage carries out phagocytosis of bacteria.

(4)

The macrophage engulfs the bacteria. It then uses its cytoplasm to surround the bacteria forming a phagocytic vacuole. It is able to do this because the cell membrane contains ~~phospholipids~~ <sup>phospholipids</sup> ~~bilayer~~ that are fluid which allows this movement and flexibility. Lysosomes then digest the phagocytic vacuole containing bacteria by destroying ~~the membrane~~ its layer and breaking down the bacteria.



**ResultsPlus**  
Examiner Comments

This is an example of one of the better quality responses where the candidate has attempted to answer the actual question.



**ResultsPlus**  
Examiner Tip

Remember what you learnt at AS as many of the principles that you were taught underpin the A2 content, such as in this question.

## Question 2 (c) (i)

Candidates have a very clear understanding of the difference between the two groups of antibiotics.

(c) Antibiotics can be used to treat bacterial infections of patients with AIDS.

(i) Distinguish between a bacteriostatic antibiotic and a bactericidal antibiotic.

(2)

A bacteriostatic antibiotic prevents the growth of bacteria for example stopping processes like protein synthesis whereas bactericidal antibiotics kill bacterial cells by breaking down the cell walls causing the cell to lyse. Bacteriostatic Bactericidal antibiotics are more effective on gram positive bacteria as it breaks down the peptidoglycan wall.



**ResultsPlus**  
Examiner Comments

We saw many responses of this one's quality. The description of a mechanism goes beyond the specification however.

## Question 2 (c) (ii)

Responses to this question were disappointing despite the question having been asked on more than one occasion in the past.

(ii) Suggest why antibiotics are not used to treat infections caused by viruses.

(1)

~~Antibiotics~~ Antibiotics does not effect viruses, only work on bacteria.



**ResultsPlus**  
Examiner Comments

This response is typical of the many that we saw, lacking specificity.



**ResultsPlus**  
Examiner Tip

Your answers need to be much more specific.

(ii) Suggest why antibiotics are not used to treat infections caused by viruses.

(1)

This is because viruses are non living, they do not have any organelles or even a cell wall



**ResultsPlus**  
Examiner Comments

There were a minority who knew that viruses were not living and therefore could not be killed by the antibiotics.

### Question 3 (a)

This question was generally answered well.

(a) Explain the meaning of the term **gross primary productivity (GPP)**.

(2)

The rate of energy incorporated into the organic matter of plants by photosynthesis.  
 $GPP = NPP + R$ .



**ResultsPlus**

**Examiner Comments**

We saw some accurate definitions of GPP; this is one such example.

(a) Explain the meaning of the term **gross primary productivity (GPP)**.

(2)

$GPP = NPP + R$  This is the rate at which energy is converted into organic molecules by an organism.



**ResultsPlus**

**Examiner Comments**

Candidates who did not score full marks either made the mistake seen in this response or else did not make it clear that GPP only refers to plants.



**ResultsPlus**

**Examiner Tip**

We don't like the idea that energy is 'converted'.

### Question 3 (b)

Unit 4 has been using data on temperature and rainfall for a number of years now and candidates are learning to pick out the trends and use their A2 knowledge to explain them. Even so, full marks were rarely seen for this question.

(b) Using the information in the table, describe and explain the effects of temperature and precipitation on GPP.

(5)

~~As temperature increases from 1°C to 20°C, the GPP increases by 12000 g m<sup>-2</sup> year<sup>-1</sup> which is the 0.~~  
As temperature increases, the GPP increases as well this is because there's increased metabolic activities therefore increased photosynthesis thus plants have a higher GPP, however, which the greatest increase of 12000 g m<sup>-2</sup> year<sup>-1</sup> produced between 1°C to 20°C.  
As precipitation increases, GPP increases. This is because there's more water available for plants therefore, water can be used in the light-dependent reaction of photosynthesis which increases the rate at which energy is incorporated.



**ResultsPlus**  
Examiner Comments

This response is an example of the standard of response that we hoped to see even though it scored only four of our mark points.

(b) Using the information in the table, describe and explain the effects of temperature and precipitation on GPP.

(5)

As temperature increases, ~~the~~ GPP increases. This is because temperature increases enzyme activity, more collisions means more enzyme-substrate complexes forming. This increases metabolic reactions like photosynthesis ~~so~~ <sup>which leads to</sup> more GPP. As precipitation increases, GPP also increases. This is because rain and melting snow provides producers with water for roots to grow. More growth and development of plant means more photosynthesis as it needs energy so there will be an increase in GPP.



**ResultsPlus**  
Examiner Comments

This was another good attempt at answering this question, but again only four marks were awarded.



**ResultsPlus**  
Examiner Tip

If a question has two command words then you must attempt to address both of them if you are to access full marks. A description and then an explanation is needed for this question to score highly.

### Question 3 (c)

This question was a novel approach and we were pleased with how the candidates responded to it. We allowed quite a wide range to the values that they could suggest and a range of explanations provided there was one relating to temperature and one to precipitation.

- (c) A desert has a mean annual temperature range of  $-8^{\circ}\text{C}$  to  $20^{\circ}\text{C}$  and a mean annual precipitation range of 0 to 20 cm.

Suggest a range for the GPP in this desert. Give reasons for your answer.

(3)

850 - 1700  $\text{kJ m}^{-2} \text{year}^{-1}$ . This is because the temperature <sup>range</sup> of the desert lies in the same range as temperate grassland, therefore the photosynthesis rate would be slightly similar however the precipitation rate is very low and fits in the range for tundra ecosystem therefore the GPP of desert has to be similar in between the GPP for these 2 ecosystems.



**ResultsPlus**  
Examiner Comments

This is one candidate's approach.

(c) A desert has a mean annual temperature range of  $-8^{\circ}\text{C}$  to  $20^{\circ}\text{C}$  and a mean annual precipitation range of 0 to 20 cm.

Suggest a range for the GPP in this desert. Give reasons for your answer.

(3)  
Its GPP range will be from  $500-6000 \text{ kg m}^{-2} \text{ year}^{-1}$ ,  
as temperate grasslands have the same temperature ~~range~~<sup>range</sup>, but have  
a much smaller minimum value for precipitation, and so it would  
be less than  $1700-1100$ . This would mean that precipitation  
would stop it from producing high levels of GPP. The  
range of precipitation is lower than that of Tundra,  
so its min. value for GPP must be lower than  
 $850 \text{ kg m}^{-2} \text{ year}^{-1}$ , and ~~upper~~<sup>max</sup> value must be lower than  $11000$   
of temperate grassland.



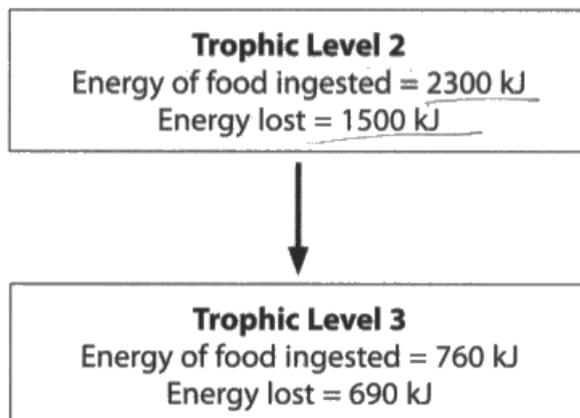
**ResultsPlus**  
Examiner Comments

This is another example, with a different range given.

### Question 3 (d)

This calculation proved to be quite discriminating. A surprising number of candidates made the two subtractions and then did not use them in their calculation.

(d) The diagram below shows the flow of energy in part of an ecosystem.



Calculate the percentage of energy from trophic level 2 that would be available for trophic level 4.

2-  $2300 - 1500 = 800 \text{ kJ}$  (3)

3-  $760 - 690 = 70 \text{ kJ}$

$\frac{70}{800} \times 100 = 8.75$

8.75 %



**ResultsPlus**  
Examiner Tip

Even if you cannot do the whole calculation at least attempt it, as there is more than likely going to be method marks that you could pick up.



**ResultsPlus**  
Examiner Comments

Some candidates, like this one, had no problem calculating the percentage.

### Question 4 (a)

We saw some good responses to this question. Candidates were describing the trend with many quantifying the change.

- 4 An experiment was carried out to investigate the effect of temperature on the activity of the enzyme RUBISCO. This enzyme is involved in the light-independent reaction of photosynthesis. *photo*

The RUBISCO was isolated from cotton plants and its activity measured.

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

Temperature / °C	Activity of RUBISCO / arbitrary units
25	2.3
30	3.2
35	4.2
40	5.0
45	4.4
50	1.7

*optimum  
denature*

- (a) Using the information in the table, explain the effects of temperatures above 40 °C on the activity of RUBISCO.

(5)

As temperature increases there is an increased kinetic energy meaning enzymes and substrates move faster resulting in more <sup>successful</sup> collisions between enzymes (RUBISCO) and substrates (RuBP and CO<sub>2</sub>). At 40°C the enzyme activity of RUBISCO is at its highest (5.0 arbitrary units) identifying the optimum temperature for collisions. As the temperature increases further bonds begin to break <sup>(e.g. hydrogen and disulphide bonds)</sup> as the enzyme RUBISCO is moving so fast, explaining the decrease of activity to 4.4 at 45°C due to enzymes beginning to lose shape. At 50°C there is a decrease to 1.7 activity due to RUBISCO denaturing meaning an enzyme-substrate complex can no longer be formed.



## ResultsPlus

Examiner Comments

There were some good explanations as given by this candidate.



## ResultsPlus

Examiner Tip

If you are describing data don't forget to quantify one of your descriptions.

- 4 An experiment was carried out to investigate the effect of temperature on the activity of the enzyme RUBISCO. This enzyme is involved in the light-independent reaction of photosynthesis.

The RUBISCO was isolated from cotton plants and its activity measured.

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

Temperature / °C	Activity of RUBISCO / arbitrary units
25	2.3
30	3.2
35	4.2
40	5.0
45	4.4
50	1.7

- (a) Using the information in the table, explain the effects of temperatures above 40 °C on the activity of RUBISCO.

(5)

The activity of RUBISCO at 40°C was the highest at 5.0. However ~~at~~ by increasing the temperature caused the activity to drop. This suggests 40°C is RUBISCO'S optimum temperature. Each enzyme works best at one temperature where they collide more therefore speeding up reactions. Above 40°C the enzyme RUBISCO starts to denature. This means the active site ~~where~~ starts to deform so substrates can't attach like a 'lock and key'. At 50°C the activity was very low

Suggesting the enzyme had denatured / died by the heat. This means no reactions can take place and the plant would die.



### ResultsPlus Examiner Comments

Not all responses were quite as good however. Despite the effect of temperature on enzymes being asked numerous times on both unit 1 and unit 4 papers we still saw responses where enzymes 'start' to denature once above their optimum temperature and enzymes being 'killed'. This response included both these errors.



### ResultsPlus Examiner Tip

Enzymes are not alive so cannot be killed. Enzymes are denaturing way below their optimum temperature, the decrease in activity is not evident however.

## Question 4 (b)

Many candidates correctly named the two substrates although we did see the products being named instead in some scripts.

(b) Name the **two** substrates that would have been used in this experiment.

(1)

RuBP + CO<sub>2</sub>



### ResultsPlus Examiner Comments

The chemical formula is acceptable provided it is correct. The abbreviation RuBP is acceptable as it is used in the specification.



### ResultsPlus Examiner Tip

If you are going to use the formula for a chemical then it must be correct. If you are not certain that you are using the correct one, write out the name in full.

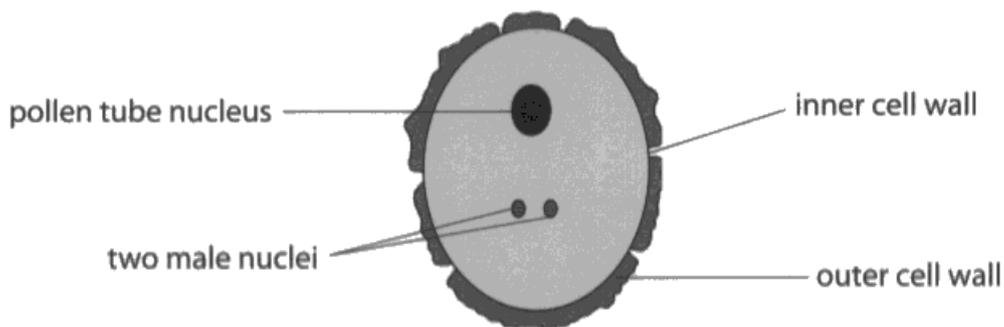
## Question 5 (a)

Responses to this question were mixed, depending on whether or not the AS content had been revised thoroughly enough and the candidate had thought to write sufficient points to meet the mark allocation.

### 5 Analysis of pollen in peat bogs can provide evidence for global warming.

Peat is acidic and has low levels of oxygen. As a result, pollen is preserved in the peat for many years.

The diagram below shows the structure of a pollen grain.



The inner cell wall contains cellulose and the outer cell wall contains sporopollenin. Sporopollenin is chemically stable and very resistant to decomposition.

(a) Describe the structure of cellulose in cell walls.

(4)

Cellulose is made up of  $\beta$ -glucose (beta glucose) molecules that are joined together by 1,4-glycosidic bonds. It is unbranched and is a long chain polymer. Multiple polymer chains form microfibrils. ~~which~~ ~~have~~ in between different polymer chains of these molecules, hydrogen bonds ~~form~~ form. The microfibrils of the cellulose are arranged in ~~mes~~ a mesh like format in the cell wall structure.



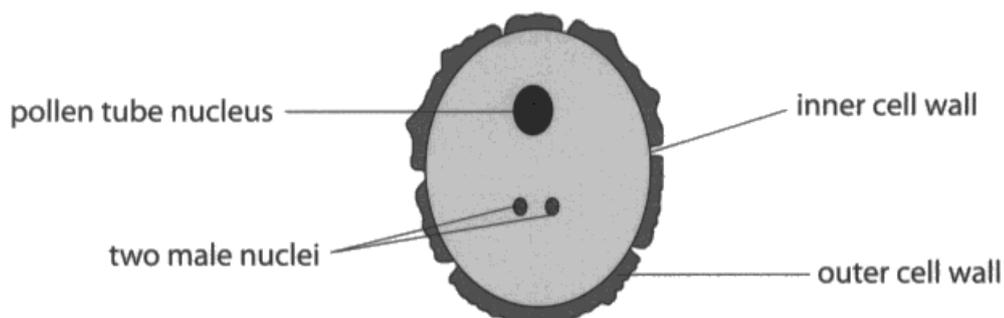
**ResultsPlus**  
Examiner Comments

We did see some very good descriptions such as this one.

5 Analysis of pollen in peat bogs can provide evidence for global warming.

Peat is acidic and has low levels of oxygen. As a result, pollen is preserved in the peat for many years.

The diagram below shows the structure of a pollen grain.



The inner cell wall contains cellulose and the outer cell wall contains sporopollenin. Sporopollenin is chemically stable and very resistant to decomposition.

(a) Describe the structure of cellulose in cell walls.

(4)

Cellulose is made up of  $\beta$  glucose with 1,4 glycosidic bonds. It contains cross-linkages. The microfibrils are laid in a criss-cross shape at  $90^\circ$  sheets.



**ResultsPlus**  
Examiner Comments

Other descriptions were not quite as accurate. These tended to get either mark point 1 or mark point 2. The odd microfibril crept in as in this response.



**ResultsPlus**  
Examiner Tip

Remember to revise all your AS work for both your unit 4 and 5 papers. Both of these papers assess AO4 which is the synoptic skill.

## Question 5 (b)

Candidates are used to describing decomposition and generally do this quite well. However, relating the lack of decomposition to the preservation of pollen in peat bogs turned out to be a lot more challenging.

(b) Suggest why pollen in peat bogs is preserved for many years.

(4)

- cell wall is resistant to decomposition
- there are low levels of oxygen within peat bogs
- decomposer organisms require oxygen to carry out respiration to provide energy for their function of breaking down organic matter (they cannot do so in low oxygen peat bogs)
- acidity of peat is not the optimum conditions for enzymes secreted by, or within, decomposer microorganisms
- the enzymes are denatured by the low pH so cannot function
- hence the pollen is not broken down / decomposed



**ResultsPlus**  
Examiner Comments

Candidates who did recognise that the question was testing them on decomposition could not link the low pH and anaerobic conditions with their effect on the microorganisms. This was a typical response.

### Question 5 (c)

We saw a limited number of very precise descriptions in response to this question.

- (c) Describe the role of each of the male nuclei in the process of fertilisation in flowering plants.

(4)

One of the male nuclei fuses with the egg cell (ovum) to form a zygote (diploid).

The other male nuclei fuses with the polar nuclei to form a triploid endosperm cell which forms the endosperm. This acts as a food reserve.

Double fertilisation has occurred



**ResultsPlus**  
Examiner Comments

This response is particularly good; exactly what we would have expected at this level.

- (c) Describe the role of each of the male nuclei in the process of fertilisation in flowering plants.

(4)

One of the male nuclei fertilises the egg of the female plant, forming zygote. This matures and grows into seeds for new offspring. The second male nuclei is used to fertilise the polar bodies (two) forming triploid endosperm nucleus. This is used for food source, for the zygotes to grow and mature.



**ResultsPlus**  
Examiner Comments

Not all responses were quite as good and were more typical of this one.



**ResultsPlus**  
Examiner Tip

Expect to be tested on any aspect of the AS specification in the unit 4 and 5 papers. Revise it all thoroughly.

## Question 6 (a)

Describing this data caused problems to a number of candidates.

- (a) Using the information in the graph, describe the changes in the pollen count in the layers of peat from a depth of 12.5 m to a depth of 13.5 m.

(3)

From 12.5 to 13.5 metres deep there is a large increase in pollen count with some fluctuation however a peak is reached at 13.5 metres of 98 au. Between 12.5 and 13.5 the total increase is 28 au, however there is a major drop drops by 63 au at 12.7 metres deep, and another major at 12.9 metres that drops by 18 au. The pollen count shows its great increase and rises steadily for the final 0.6 metres deep, when Toba erupted.



### ResultsPlus Examiner Comments

As in this response, mark points 1 and 2 were the most common.



### ResultsPlus Examiner Tip

When asked to describe changes in data, start with a comment about the overall change and then do a bit of maths to quantify it. This should get you two marks. Then you can go on to describe the changes in more detail to try and pick up the remaining marks.

## Question 6 (b)

Responses to this were disappointing. Candidates did not stop and think about the context of the question and what the layers of pollen in a peat bog really represent. Only a minority thought about destruction of a particular layer of peat.

- (b) Suggest why there is no data for some of the depths.

(1)

It may have been disturbed at that level so no sample could be taken.



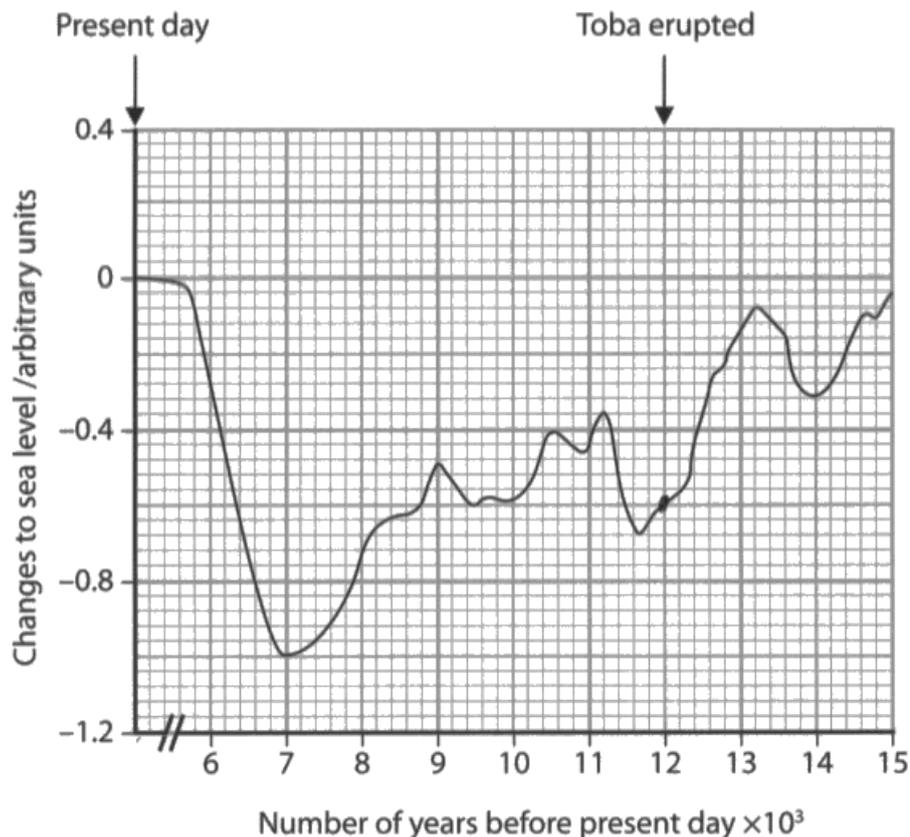
### ResultsPlus Examiner Comments

We gave this candidate the benefit of the doubt but would have preferred them to specify what 'it' referred to.

### Question 6 (c)

We saw lots of very good ideas about the effect of increase in temperature on the sea level. Disappointingly, very few candidates thought to discuss the effect of a decrease in temperature.

(c) The graph below shows changes to sea levels, compared to the present day, in the oceans around Greenland.



Suggest why temperature changes affect sea level.

(2)

As the temperature increases, polar ice caps on the North pole melt, thus increasing the overall sea level. In more confined <sup>seas</sup> ~~areas such as lakes~~, higher temperatures may cause the water to evaporate more thus decreasing the sea level, but this is very unlikely.



**ResultsPlus**  
Examiner Comments

This candidate has tried to give us two explanations for an increase in temperature but this does not fully answer the question.



**ResultsPlus**  
Examiner Tip

Always check the mark allocation for a question, especially a 'suggest' question. Two marks means that two suggestions are necessary.

Don't forget that a change can be an increase or a decrease.

### Question 6 (d) (i)

Candidates could generally describe the evidence but some did not use both graphs.

(d) It is claimed that the volcanic eruption of Toba caused a change in world climate.

(i) Using the information in both graphs, describe the evidence that supports this claim.

(2)

After the eruption the pollen levels in the peat bogs are considerably lower than before hand, almost immediately there was a drop of 38 units. Additionally the sea levels dropped to their lowest points  $\approx -0.7$



**ResultsPlus**  
Examiner Comments

A well-expressed response.



**ResultsPlus**  
Examiner Tip

If there are two sets of data, as in this question, you will not get full marks if you don't use both sets of data.

### Question 6 (d) (ii)

All of our suggestions about why the claim may not be true were seen, but it was rare for more than one or two to be given in any one response. A reference to fluctuations was the most common suggestion.

(ii) Using the information in both graphs, suggest why this claim may not be true.

(3)

Both graphs fluctuate heavily with data, therefore the reliability is unknown. For example sea level was already on the decline when Toba erupted and the trend shown on the graph could have been natural (from 0.6-0.7). Furthermore before Toba erupted, pollen counts had been as low as 30 and again the data may have been a natural occurrence.



**ResultsPlus**  
Examiner Comments

This candidate has described the fluctuations.



**ResultsPlus**  
Examiner Tip

Use the structure of the question and the mark allocation to help you structure your answer. You are asked about both graphs so there must be at least one mark for a comment about each. In a suggest question it is also a good idea to give more suggestions than there are marks allocated to the question. Just don't do this in a question that has the command word Give or State or Name.

## Question 7 (a)

We have asked questions on body temperature and ambient temperature a number of times in the past, but not usually in relation to the importance of taking the readings as soon as possible. Many candidates gave us our first two marking points but far fewer commented on the fact that the ambient temperature alters over time.

7 A pathologist can use a number of methods to estimate the time of death of a body found at a crime scene.

(a) The pathologist will measure the body temperature and the temperature of the surroundings.

Explain why it is necessary to take these two measurements as soon as possible.

(3)

- ambient temperature affects body temperature
- ambient temperature will depend affect rate of decomposition of body
- Temperature of surroundings may alter throughout the day
  - important to obtain for accurate results
- Calculates period of time dead
- Body temperature cools lowers after death



**ResultsPlus**  
Examiner Comments

This is a clear response of the standard that we were hoping for.

7 A pathologist can use a number of methods to estimate the time of death of a body found at a crime scene.

(a) The pathologist will measure the body temperature and the temperature of the surroundings.

Explain why it is necessary to take these two measurements as soon as possible.

(3)

to determine time of death

fall in body temperature is affected by temp of surroundings

to obtain accurate time of death which is not biased

as soon as person dies, metabolic reaction rates will decrease so <sup>core</sup> temperature will ~~fall~~

start to fall immediately



**ResultsPlus**

**Examiner Comments**

This response typically gave us the first two points on the mark scheme and in addition our fourth point. A number of candidates who tried to give us point 4 worded it poorly and told us that the readings would be more accurate instead of the time of death.

### Question 7 (b) (i)

The y axis gave some candidates a problem as the intervals were a bit different from previous graphs. We allowed a range of values between 36.26 and 36.28 for the reading at 07:00.

- (i) Using the information in the graph, calculate the maximum change in body temperature over this period of 24 hours.

(2)

$$37.5 = \text{max.}$$

$$36.26 = \text{lowest}$$

$$37.5 - 36.26 = 1.24 \text{ change}$$

$$\underline{\underline{1.24}} \text{ } ^\circ\text{C}$$



**ResultsPlus**  
Examiner Comments

A clearly laid out calculation using acceptable values read from the graph.



**ResultsPlus**  
Examiner Tip

Always show your working.

### Question 7 (b) (ii)

This question turned out to be the most challenging question on the paper with the majority of candidates struggling to pick up two marks.

- (ii) Suggest how a pathologist could use the information in this graph to estimate the time of death of a body at a crime scene.

(2)

The information in the graph shows that that the body ~~with~~ temperature will be affected by the time of day in which the person died. For example if the person died at 5pm their body temperature would start decreasing from  $37.5^{\circ}\text{C}$  whereas if they died at 5am their average temp would already be fairly low at  $36.2^{\circ}\text{C}$  and so their body would take a shorter time to decrease to surrounding temperature



**ResultsPlus**  
Examiner Comments

This candidate clearly understood the graph and its role and made one of the better attempts at answering this question.

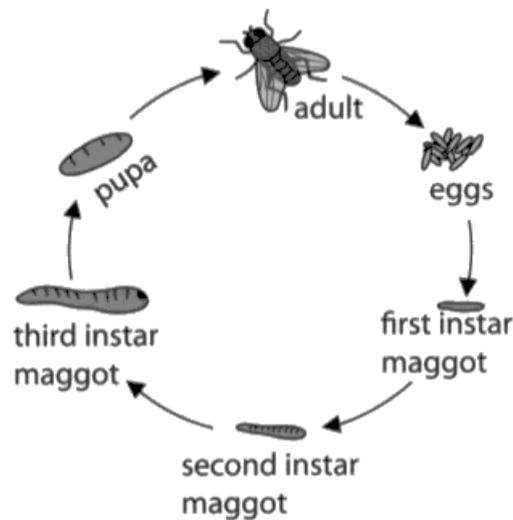
## Question 7 (c)

Few candidates really thought about the question being asked before launching into their response.

Few picked up the subtlety of the context so mark points 3 and 4 were rare. Those who tried to make mark point 4 usually stated that the second instar maggot turns into the pupa, which is clearly not the case if they looked at the diagram and thought about their answer.

\*(c) A pathologist can also use forensic entomology to estimate the time of death of a body.

The diagram below shows the life cycle of a fly.



Describe an investigation that could be carried out to study the effect of temperature on the time taken for the first instar maggot to become a pupa.

(5)

~~Genetically~~ just instar maggots of the same age could be taken and grown at 5 different temperatures ( $0^{\circ}\text{C}$ ,  $10^{\circ}\text{C}$ ,  $20^{\circ}\text{C}$ ,  $30^{\circ}\text{C}$ ,  $40^{\circ}\text{C}$ ). They must be incubated at these temperatures ~~until~~ with same amounts of nutrients and water available to them. The time taken for the instar maggots to become a pupa is then recorded. This method should be repeated to calculate a mean. A graph can then be plotted of temperature against time taken to become a pupa.

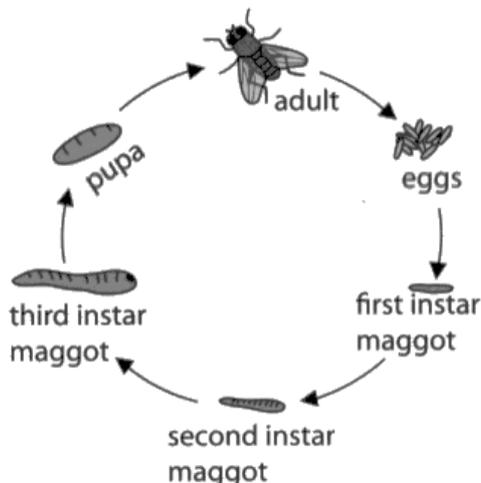


**ResultsPlus**  
Examiner Comments

This candidate was one of the exceptions who did try to answer the question in its context, but we did not like their reference to 'nutrients' being supplied.

\*(c) A pathologist can also use forensic entomology to estimate the time of death of a body.

The diagram below shows the life cycle of a fly.



Describe an investigation that could be carried out to study the effect of temperature on the time taken for the first instar maggot to become a pupa.

(5)

Take 5 different groups of first instar maggots, incubating each group at different temperatures (using a water bath / an incubator) - 20°C, 30°C, 40°C, 50°C and 60°C, recording the time taken in each group (so, at each temperature) for the first maggot to become a pupa, repeating the experiment <sup>at each temperature</sup> and averaging results. During the experiment, ~~other~~ ensure the first instar maggots should receive the same diet / the correct amount of minerals for them to progress through their life cycle, to ensure temperature is the only factor affecting the rate of life cycle progress, (or to decrease influence of other factors).

(Total for Question 7 = 12 marks)



**ResultsPlus**  
Examiner Comments

Candidates have learnt from numerous past paper mark schemes that if temperature is the independent variable then there will be marks for stating that a range of temperatures should be used and that a waterbath is the correct piece of equipment to use. However some thought needs to be given to their answer as stated temperatures have to be sensible; we felt that 60°C was just a bit too hot.

## Question 8 (a)

Disappointingly we rarely saw three differences given even though it is a very straight forward question that has been used on a range of papers in the past.

8 One gene can give rise to more than one protein.

(a) Give **three** differences between fibrous and globular proteins.

(3)

Globular are soluble, fibrous are insoluble.

Globular are folded, fibrous are ~~not~~ straight and thin.

Globular are used in reactions eg as enzymes, fibrous are used as structural proteins.



### ResultsPlus Examiner Comments

This candidate has attempted to make three comparisons but only two of them have sufficient detail in them.



### ResultsPlus Examiner Tip

If there are three marks available then three differences are needed.

All AS content needs to be revised for both A2 papers.

Comparative points must be given in the same sentence.

## Question 8 (b)

Post-transcriptional modification has been asked on more than one occasion in the past but not in this context. The introduction to the question clearly states that the two proteins are of different length and therefore it is expected that the response should explain how this is achieved. It is an AO2 question not a simple AO1 recall question.

\*(b) Sex determination in *Drosophila* (fruit fly) is controlled by the *Sxl* gene that codes for the *Sxl* protein. The *Sxl* gene is the same in female and male *Drosophila*.

The length of the protein in the female *Drosophila* is different from the length of the protein in the male *Drosophila*.

Suggest how the same *Sxl* gene can give rise to these different proteins.

(6)

The DNA of the *Sxl* gene would be transcribed into mRNA. This would <sup>involve</sup> ~~involve~~ the DNA double helix splitting ~~into~~ complementary RNA nucleotides lining up to ~~again~~ organic bases (e.g. guanine pairs with cytosine). The mRNA molecule would leave the nucleus. It would then be modified through splicing. Introns would be ~~removed~~ <sup>removed</sup> and exons joined together in a different sequence. Different numbers of exons would be present. The mRNA would then be translated on a ribosome. Free tRNA molecules attached to an amino acid would join to complementary codons, forming a polypeptide. In the post-transcriptional changes, female *Drosophila* may have an mRNA molecule with more exons, resulting in a longer chain of amino acids and a longer protein than the male.



**ResultsPlus**  
Examiner Comments

This is one of the relatively few responses that actually attempts to answer the question.



**ResultsPlus**  
Examiner Tip

Read the context of the question carefully and ensure that your answer is tailored to that context.

\*(b) Sex determination in *Drosophila* (fruit fly) is controlled by the *Sxl* gene that codes for the Sxl protein. The *Sxl* gene is the same in female and male *Drosophila*.

The length of the protein in the female *Drosophila* is different from the length of the protein in the male *Drosophila*.

Suggest how the same *Sxl* gene can give rise to these different proteins.

(6)

After transcription of the *Sxl* gene, the pre-mRNA still has introns so they are removed using spliceosomes. Exons are put back in different ways,\* which changes the primary ~~sequence~~ structure of the protein.

\*and some exons may be taken out, which is why the two proteins are different lengths.

These are post-transcriptional changes. The mRNA is then transcribed and a different tRNA molecules bring different amino acids. The R groups change and therefore the folding of the proteins will be different!



**ResultsPlus**  
Examiner Comments

The first four mark points were frequently awarded; candidates clearly knew what is involved in post-transcriptional modification.

## **Paper Summary**

At the end of a specification all specification points have been tested on a number of occasions in previous papers, but in different contexts.

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

- focus more on the context of the question and write a response that applies their knowledge rather than simply show their recalled knowledge
- use the command words and mark allocation to structure their response
- learn their AS content more thoroughly and apply it to the context of the question
- make calculations to quantify their data descriptions.

Read the information and look at the stimulus material supplied before making your response. You might think you recognise the question as some have been asked a number of times before but there will be differences.

## **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>

Ofqual



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