

Examiners' Report
June 2016

GCE Biology 6BI05 01

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June 2016

Publications Code 6BI05_01_1606_ER

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Introduction

The summer 2016 unit 5 paper offered candidates a diverse array of different question styles to tackle. It was most encouraging to read candidate responses as many delivered well crafted, targetted and appropriately knowledge-rich answers that displayed their understanding of the subject matter.

It should be noted, however, there seemed to be a greater number of responses which proved challenging to read due to handwriting issues such that they were, on occasion, insufficiently clear to award marks.

Question 1 (c)

An encouraging number of candidates wrote clear and precise answers to this item. They displayed a sound understanding of the antagonistic nature of muscles and then referred to the correct muscles to move the footballers leg in the direction shown in the diagram.

A good answer displaying several of the mark points.

- (c) Suggest how tendons and antagonistic muscles cause the lower leg to move in the direction shown by the arrow in the diagram below.

(4)



The flexor muscle relaxes and the extensor muscle contracts to straighten the leg. Tendons attach muscle to bone so ensure the bone moves when the muscle contracts.



ResultsPlus Examiner Comments

This answer gains marking point 3, marking point 1 and then marking point 2 in the first sentence. It then offers the most commonly awarded point: marking point 6, to gain full marks.



ResultsPlus Examiner Tip

This response tackles the question immediately, rather than repeating the question stem which is unnecessary. It does not describe the behaviour of the muscles when the leg is bent which a number of candidates felt obliged to.

Another encouraging response that achieved full marks including a clear description of the antagonistic action of muscles.

- (c) Suggest how tendons and antagonistic muscles cause the lower leg to move in the direction shown by the arrow in the diagram below.

(4)



Tendons attach muscle to bone. When the muscle needs to contract the tendons do not move and all the force is transmitted to the bone so bones can move. This is because the tendons are inelastic. Antagonistic muscles work in opposing ways - this is because muscles cannot extend themselves. To kick the ball, the flexors relax and the extensors contract to extend and kick the ball.



ResultsPlus
Examiner Comments

The answer starts with marking point 6 on the first line.

The fourth sentence starts the description of antagonistic behaviour and the subsequent sentence completes a clear explanation of this element so marking point 4 is given.

The final sentence then gains marking point 3 and marking point 1.

Question 2 (a) (i)

This item required candidates to suggest two variables that needed to be kept constant in an investigation. However, the question stem described aspects of the investigation which meant that some suggestions could not be awarded. Whilst two common incorrect examples are given in the responses below, many candidates offered creditworthy suggestions.

This example shows two suggested variables, neither of which could be credited. However, the reasons are different.

- (a) (i) Suggest **two** variables, other than temperature, that need to be kept constant in this investigation so that valid results can be collected.

(2)

The mass of the carrots used (100g).
The moisture content of the air inside the bag.



ResultsPlus Examiner Comments

The question stem states that 100g of carrot cubes were used and therefore the mass has already been taken into account so cannot be awarded a mark.

The investigation only used one bag and therefore, the moisture content was controlled.



ResultsPlus Examiner Tip

Always check the details given to see if a particular variable has already been referred to in the question.

Question 2 (a) (ii)

This question required candidates to discuss the role of oxygen in respiration. Generally this question delivered a bimodal response. An encouraging number offered detailed and accurate descriptions as per the first example below. A minority, however, offered a rather more general overview as per the second example.

This response delivers a short and accurate answer that gains full marks.

(ii) Explain the role of oxygen in the cells of the carrot cubes.

(3)

Oxygen is taken into the cells of the carrot cubes for cellular respiration. The oxygen is the final acceptor for the electrons and protons of hydrogen after the electron transport chain and production of ATP. This forms the product water H_2O .



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Examiner Comments

The second sentence gained marking point 1 and 2. However it was not sufficiently clear to be awarded marking point 3. The final sentence achieves marking point 4.

This response lacked the precision and detail needed to elicit more than one mark.

(ii) Explain the role of oxygen in the cells of the carrot cubes.

(3)

Oxygen is required for aerobic respiration to occur, along with glucose to produce water and carbon dioxide. Oxygen is a source of energy in the carrot cubes, and can be converted to energy.



ResultsPlus
Examiner Comments

The first sentence refers to the production of water in the context of oxygen, hence marking point 4 can be given. However, the remainder is inaccurate.

Question 2 (b)

It was pleasing to see an encouraging number of responses that showed a thorough appreciation of how carbon dioxide is produced within the mitochondrion.

This response shows a sound understanding of the material and gained full marks.

(b) Explain how the carrots produce carbon dioxide at the start of this investigation.

(4)

At the start of the investigation there is plenty of oxygen for aerobic respiration to take place and oxidative phosphorylation of ADP to produce ATP. CO_2 is produced in the link reaction when pyruvate is decarboxylated and oxidised into Acetyl-CoA. More CO_2 is produced in the Krebs cycle in the mitochondrial matrix when a 6^{carbon} compound turns into a 5 carbon compound, and then the 5 carbon compound into a 4 carbon compound. 3 moles of CO_2 are produced per pyruvate molecule.



ResultsPlus Examiner Comments

The first sentence gives an appropriate introduction that gains marking point 1. The second sentence offers marking point 4, marking point 2 and marking point 5 in the context of the link reaction. It then focusses on the Krebs cycle.



ResultsPlus Examiner Tip

Always check the mark allocation. As this is a 4 mark item, it is likely to demand detail.

Question 2 (c)

The majority of candidates were able to appropriately comment on the data, noting the positive correlation. However, fewer then offered an explanation of this data as was required.

After an initial description, this response does not tackle the question being asked, so only 1 mark out of 3 can be awarded.

(c) The investigation was repeated at storage temperatures of 5 °C and 10 °C.

The table below shows the change in percentage of carbon dioxide in the bag at the end of the investigation compared with the start of the investigation for all three storage temperatures.

Storage temperature / °C	Change in percentage of carbon dioxide (%)
1	+ 8.1
5	+ 14.1
10	+ 16.2

Explain the effect of temperature on the change in the percentage of carbon dioxide in the bag.

(3)

As the temperature increases, the change in percentage of carbon dioxide increases. The largest difference is between 1°C and 5°C where there is a ⁴³~~42~~% increase in percentage CO₂.



ResultsPlus Examiner Comments

The candidate has made a suitable comment on the relationship between temperature change and the change in percentage of carbon dioxide in the bag for marking point 1. However, the candidate has not then elaborated as to why this is the case as required by the command word explain.



ResultsPlus Examiner Tip

Always consider the command word. In this case it is 'explain'. Responses, therefore, need to offer reasons for the trends seen in the data rather than just a description of trends.

Question 2 (d)

Whilst most candidates appreciated that the carrot cells could undergo anaerobic respiration, some incorrectly referred to photosynthesis.

This response illustrates another common misconception for some candidates.

(d) Suggest why the carrot tissue could survive when no oxygen was left in the bag.

(1)

Carrot undergo anaerobic respiration whereby pyruvate is converted to lactate by the getting reduced from reduced NAD

(Total for Question 2 = 13 marks)



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Examiner Comments

Whilst the candidate has correctly referred to anaerobic respiration, the latter part of the sentence describes such respiration in animal cells rather than plant cells so the mark cannot be awarded.



ResultsPlus

Examiner Tip

Make sure that all of your answer is correct.

Question 3 (a)

This item required candidates to define the term myogenic. Some found this challenging and a minority described a monohybrid cross rather than myogenic. Marking point 1 was seen more commonly than marking point 2.

Question 3 (b)

Whilst there were a number of excellent responses explaining how an ECG can be used to calculate heart rate, many candidates found this question item challenging.

This is a sound response that gains full marks.

(b) Explain how an electrocardiogram (ECG) can be used to calculate a person's heart rate.

(3)

An electrocardiogram shows the electrical activity of a heart during the cardiac cycle, so it will show the P, QRS, and T waves which correspond to atrial systole, ventricular systole and diastole. ECG - which is one beat. If you identify one beat, then count the frequencies of one beat in a minute, then that is the heart rate.



ResultsPlus Examiner Comments

Like many answers, it starts by stating marking point 1. Indeed, this marking point was often the only point seen and awarded. In this case, however, much of the remainder of the first sentence goes on to describe how to identify one heart beat. The final sentence can be awarded marking point 3.



ResultsPlus Examiner Tip

Make sure that the answer matches the question. It was not uncommon to see answers referring to breathing rate rather than heart rate or offering a description of how to set up the ECG rather than how to use it to calculate heart rate.

Question 3 (c)

It was most pleasing to see a number of fine answers to this question that achieved full marks. Many were able to spell the technical terms identified correctly, through the full mark range seen.

This is an encouraging answer that is written in a logical and sequential manner. Indeed, this answer offers six different marking points.

*(c) Workers in the brewing industry may be at risk due to the carbon dioxide released by yeast fermentation.

Atmospheric air contains between 0.03% and 0.04% carbon dioxide.

A concentration of 5% carbon dioxide in the air causes a change in the heart rate of people exposed to this concentration.

Explain why a carbon dioxide concentration of 5% causes a change in heart rate.

(5)

As CO_2 concentration in the lungs increases, blood CO_2 concentration increases. CO_2 in the blood causes pH of the blood to fall because CO_2 is an acid gas in solution. A fall in pH is detected by chemoreceptors in the carotid ~~the~~ arteries and the aortic body. Chemoreceptors send impulses ^{via sensory neurones} to the cardiovascular centre in the medulla oblongata. The medulla sends more frequent impulses via a sympathetic nerve to the sinoatrial node of the heart. This causes the SAN to increase its rate of contraction, and so heart rate increases.



ResultsPlus

Examiner Comments

The passage begins by referring to a raised carbon dioxide level in the lungs. However, this is insufficient detail for marking point 1. It then offers marking point 2, both in terms of raised blood carbon dioxide concentration and lowered blood pH.

Subsequently, the role of the chemoreceptors and the location are given for marking point 3 and both the cardiovascular control centre and the medulla for marking point 4.

There is then a creditworthy reference to the sympathetic nerve and within that sentence also marking point 6 is seen.

There is a reference to SAN behaviour but this cannot gain marking point 8. However, the account is completed on the last line with marking point 9.



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Examiner Tip

Writing in a logical and sequential manner increases the chance of offering all the salient points needed to gain the higher marks.

Question 4 (a)

This proved a challenging item for many candidates. In some cases this was due to a lack of precision with reference to twins as seen in the example below.

A general and confused response that did not score any marks.

4 A number of investigations have been carried out to study the effect of nature and nurture on human development.

(a) Explain how twin studies could be used to compare the effects of nature and nurture on human development.

(4)

Nature is what the human is born with
Nurture is what the child experiences and gains from the surroundings. Twins are very similar → identical twins have exactly the same genes. If you separate them at birth and let them grow up in different environments they would develop different behaviour and characteristics due to the different ~~nature~~ nurture they are in.



ResultsPlus Examiner Comments

The answer illustrates a commonly seen statement that identical twins have the same genes which is not marking point 1.



ResultsPlus Examiner Tip

This candidate confuses nature and nurture. Others gave responses in which the quality of the handwriting made it impossible to differentiate between nature and nurture. Make sure your handwriting is legible.

Question 4 (b) (i)

A good number of candidates dealt effectively with this item, though some seemed unclear about the nature of a cross-cultural study.

This answer gains 1 mark and demonstrates two common aspects that could not be awarded marks.

(b) (i) Facial expressions can show different emotions.

Explain how a cross-cultural study could be used to investigate whether recognising different emotions through facial expression is due to nature or nurture.

(2)

The cross-cultural study can be used to compare the effect of different environments on the ability to recognise emotions through facial expressions. People from different cultures would be studied which would show the effect of nurture, and twins could also be used to compare the effect of nature and nurture.



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Examiner Comments

The reference to different environments is not the same as different cultures so marking point 1 could not be achieved.

The first part of the second sentence refers to studying people from different cultures so is marking point 1. However, the middle part of the sentence does not link outcome with nurture so marking point 2 is not given.

The latter part of the sentence then reverts to a twin study rather than a cross-cultural study.

Question 4 (b) (ii)

Generally candidates offered a pleasing array of creditworthy suggestions for this item that required them to offer two variables that should be taken into account to enable the described cross-cultural study to produce valid results.

This candidate made two sensible suggestions to help enable valid results to be gathered so gained both marks.

(ii) Suggest how this cross-cultural study could be carried out to make sure that the results are valid.

(2)

Get two groups of people of the same age, ~~similar~~. Two groups should have the same amount of people to make comparisons valid.

Control all variable when presenting pictures of facial expressions: same person in the picture. Make sure the ways the pictures are presented are the same for both groups: all on computer screens or the same picture.

(Total for Question 4 = 8 marks)



ResultsPlus Examiner Comments

The start of the response refers to an appropriate sampling technique marking point 2, that is, age of cohort. This was, along with gender, the most commonly credited answer. The reference to using the same number of people is not equivalent to marking point 1.

The second paragraph, however, gives two different examples of using a standardised methodology to help elicit valid data.



ResultsPlus Examiner Tip

Always make sure that any variables you offer are relevant to the question or example being described.

Question 5 (a) (i)

This item required candidates to consider tabulated data and make inferences and then comment on it in terms of concentration gradients. This proved challenging for many.

This is a sound response that scores one mark and demonstrates a commonly seen, non credit worthy, comment.

5 Neurones are cells involved in coordination and control within an animal.

(a) The table below shows the concentration of sodium ions and potassium ions in the cytoplasm of a neurone and in the fluid outside the neurone.

Ion	Concentration of ion / mmol dm^{-3}	
	Cytoplasm	Fluid outside the neurone
Sodium	15	150
Potassium	150	5

(i) Using the information in the table, comment on the concentration gradients of these ions.

(2)

The concentration gradients are opposite. Sodium has a higher concentration outside the neurone so if able to sodium would flow into the neurone down the concentration gradient (through voltage-gated Na^+ gates). Potassiums concentration gradient goes down to outside. K^+ would flow out of the cell.

Concentration gradient goes from where the ion is in a higher concentration to where it is in a lower concentration. If allowed diffusion would occur down gradient until both concentrations equal.



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Examiner Comments

The short first sentence offers marking point 3. This is then further confirmed. However, like many candidates' answers, it did not focus sufficiently clearly on the concentration gradients to gain marking point 1, rather it commented on the differences in the concentrations as given in the table.



ResultsPlus
Examiner Tip

Always consider both the command word and the rest of the question when preparing a response.

Question 5 (a) (ii)

This item enabled some candidates to clearly display a clear and detailed understanding of the physiology of neurones. It elicited the full mark range.

This example immediately tackled the question and focussed on explaining how the ion concentrations, as shown in the table provided, were re-established. It is not a complete answer and only gained three out of the four available.

- (ii) During an action potential the distribution of sodium and potassium ions changes.

Explain how proteins in the cell surface membrane of this neurone enable the concentrations of these ions to **return** to those shown in the table.

(4)

Sodium ion channels close. Sodium ions cannot diffuse back into the neurone. Potassium ion channels open. Potassium ions move down their concentration gradient, out of into the neurone. Neurone becomes hyperpolarised as too much potassium ions leave. The sodium-potassium pump restores resting potential of the neurone. Sodium-potassium pump ~~activ~~ carries 3 sodium ions out of the neurone and 2 potassium ions into the neurone, by active transport, using ATP.



ResultsPlus Examiner Comments

The first two sentences refer to sodium ions and repolarising which gained marking points 2 and 3. The reference to potassium ions does not explain how the concentration is higher within the neurone. However, towards the end of the passage, the candidate gives an appropriate reference to the sodium-potassium pump and the movement of named ions so gained marking point 6.



ResultsPlus Examiner Tip

Tackle the question being asked. In many cases, candidates felt the need to work through depolarisation and an action potential despite the question asking, in bold, for how the ions are returned to the values shown in the table.

Question 5 (b)

It was pleasing to see a plethora of precise and detailed descriptions of what occurs at a synapse when an impulse arrives.

This is a sound response but illustrates perhaps the most common reason why some candidates did not gain full marks.

(b) Describe how the arrival of a nerve impulse at a synapse causes the release of neurotransmitters.

(3)

If causes calcium ions to flow in as the channels become open and they diffuse down the concentration gradient. This causes vesicles containing neurotransmitters to bond to the pre-synaptic membrane. This then causes the vesicles to release neurotransmitter across the synaptic cleft where it is taken up by receptors on the post-synaptic membrane.



ResultsPlus Examiner Comments

The initial description of the movement of calcium ions is sound except that it is unclear where they are going so marking point 1 cannot be gained. However, the second sentence gives a clear description of vesicles with neurotransmitter fusing with the presynaptic membrane for marking points 2 and 3.



ResultsPlus Examiner Tip

Look to offer the precise location if this is relevant to the question.

Question 6 (a) (i)

A number of candidates found this maths item quite hard. One commonly encountered element that led to some candidates not gaining full marks is given in the example below.

A typical response that gained 1 mark.

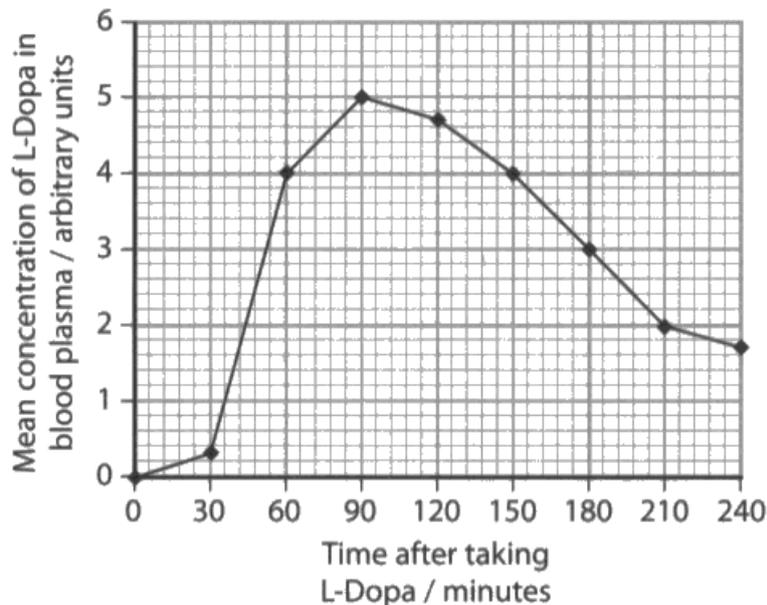
6 Humans and sea anemones have nervous systems with synapses.

(a) L-Dopa is a drug used to treat people with Parkinson's disease.

An investigation was carried out to study the uptake of L-Dopa from the gut into the blood plasma of people with Parkinson's disease.

A number of people with Parkinson's disease were each given a tablet containing 200 mg of L-Dopa. The concentration of L-Dopa in the blood plasma of each person was then recorded over a period of four hours.

The mean results are shown in the graph below.



(i) Using the information in the graph, calculate the mean rate of uptake of L-Dopa from 0 to 90 minutes.

Show your working.

(2)

$$\begin{aligned} 0 &= 0 \\ 90 &= 90 \text{ au} \end{aligned}$$

$$\frac{5}{90} = 0.056$$

.....0.056



ResultsPlus Examiner Comments

This answer gained the working out marking point 1, but did not gain both marks as no units were supplied with the answer.



ResultsPlus Examiner Tip

This response illustrates two things: (1) It is worth showing your working as this candidate gained half the available marks; and (2) if units are not provided, make sure you supply them accurately, that is, au/min.

Question 6 (a) (ii)

Most candidates were able to make a sound attempt at this question that required them to suggest reasons why the blood concentration of the drug L-Dopa decreased 90 minutes after intake.

This example was fairly typical in that it offered the two most commonly encountered points.

- (ii) Suggest an explanation for the decrease in the mean concentration of L-Dopa in the blood plasma after 90 minutes.

(4)

When L-Dopa is taken after 90 minutes of it being in the blood it would have been uptaken by the brain crossing the blood-brain barrier where it is converted into dopamine. This results in the concentration of L-Dopa decreasing after 90 minutes as it has started to be absorbed by the brain. Where it is used to carry impulses in the brain across synapses to reduce the effects of parkinsons due to a lack of dopamine.



ResultsPlus Examiner Comments

The first sentence initially refers to marking point 3 and finishes with marking point 4.

The second sentence reconfirms marking point 3 in terms of the statement 'absorbed by the brain'.

Question 6 (b) (i)

Many candidates displayed their understanding of habituation in the context of the sea anemone, as illustrated in the example provided.

This candidate has offered both required elements and so gains the mark.

- (i) Suggest what the student would observe when the sea anemone was fully habituated.

When he touched the sea anemone, it ⁽¹⁾
would not withdraw its tentacles at all.



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Examiner Comments

This answer refers to both the stimulus and the response so can be awarded the mark.

Question 6 (b) (ii)

Some candidates tackled this question item well, giving good detail. However, others found it challenging and the full mark range was seen.

This example illustrates a clear and logical answer that gains full marks.

- (ii) The student investigated the length of time it took sea anemones to lose their habituation.

Suggest how the student carried out this investigation.

(3)

~~#~~ The student must fully habituate a number of (10) sea anemones of the same species until they stop withdrawing the tentacles. He should then touch ~~the~~^a sea anemone after waiting for a set period of time (30 minutes). ~~He~~ He should leave the next sea anemone for 30 minutes longer before touching it, ~~and so on~~^{and so on}. If the sea anemone withdraws its tentacles, it has lost its habituation and the time should be recorded. The student should repeat the experiment to increase the reliability of the results.

(Total for Question 6 = 10 marks)



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Examiner Comments

The initial sentence gives a description of habituating sea anemones but in the context of the answer it can be assumed that the sea anemones subsequently being referred to are those that have been habituated so marking point 1 can be awarded.

The next two sentences appropriately describe leaving sea anemones for differing lengths of time before stimulating them for marking point 2.

The next sentence then describes recording the time at which the habituation is lost.

Neither the reference to ten sea anemones in the opening sentence, nor the final sentence give sufficient detail for marking point 3.

This response was fairly representative of a sizeable minority of candidates. It tended to describe the habituation process for the sea anemone rather than tackling the question which focussed on how to judge the time when a habituated sea anemone had lost its habituation.

- (ii) The student investigated the length of time it took sea anemones to lose their habituation.

Suggest how the student carried out this investigation.

(3)

Touch the tentacles and time how long it takes for the tentacles to withdraw. Wait until the tentacles are fully back out and then repeat. Note how many touches it took for the tentacles to have a ~~the~~ long time (tentacles do not withdraw).

Repeat the investigation

Handle the organism with care.

Keep factors such as temperature constant.



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Examiner Comments

There were no awardable marks seen in this answer.

Question 7 (a) (i)

This question that asked about the reasons for wanting to suck carbon dioxide out of the atmosphere was tackled well by the majority of candidates.

An encouraging answer that gained both marks.

7 The scientific article you have studied is from *Science News*.

Use the information from the article and your own knowledge to answer the following questions.

(a) Ginkgo BioWorks could engineer a bacterium to 'suck carbon dioxide out of the atmosphere' (paragraph 5).

(i) Suggest why there may be a need to 'suck carbon dioxide out of the atmosphere'.

(2)

CO₂ is a greenhouse gas that contributes to global warming by trapping IR waves ~~that~~ reflected from the earth in the atmosphere increasing its temperature globally. The amount of CO₂ in the atmosphere is also increasing due to burning fossil fuels.



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Examiner Comments

The initial statement gains marking point 1 and then gains marking point 2 at the end of the first line into the second line. Had the candidate not referred to global warming, the description given in the remainder of the passage would still have been marking point 2.

Question 7 (a) (ii)

This question item about genetic engineering of a bacterium to remove carbon dioxide from the atmosphere enabled a pleasing number of candidates to showcase a thorough understanding of this topic area. Having said this, the full mark allocation was seen.

This is an example of a strong answer that was tackled in a logical manner and offered more than the maximum mark allocation.

*(ii) Suggest how Ginkgo BioWorks could engineer such a bacterium.

(6)

Isolate ~~using~~ a specific gene that is designed to cause ~~an~~ an organism to remove CO₂ from the atmosphere such as photosynthesis in plants. Using a restriction enzyme, the enzyme will remove said gene from the DNA of ~~the~~ the organism, and will remove a section of DNA from a bacterium plasmid. As the same restriction enzyme is used, the bases at the end of the gene have been 'cut' in the same place so that ends are complementary to one another or 'sticky'. Ligase enzyme binds the plasmid to the gene by creating phosphodiester bonds. ~~and~~



ResultsPlus Examiner Comments

The first line of the first sentence refers to isolating the specific gene for use which can be awarded marking point 1.

The second sentence starts with a reference to a restriction enzyme which is marking point 2. It then moves on to describing how this restriction enzyme can be used on the plasmid. This would be credited with marking point 3. Furthermore, the third sentence confirms that the candidate is referring to the same enzyme being used. This sentence also refers to the production of sticky ends for marking point 4 but the reference to 'complementary' on its own is unlikely to gain marking point 5.

The next sentence names the ligase enzyme and gives a suitable description of its function for marking point 6 and then refers to the formation of phosphodiester bonds for marking point 7.



ResultsPlus Examiner Tip

Whilst this answer follows the sequence given in the mark scheme, this is not the only logical sequence a candidate could use. For example, a response could start with a description of the use of a restriction enzyme on a plasmid and then refer to the enzyme being used on a gene involved in extracting carbon dioxide from the atmosphere.

Question 7 (b)

This item required candidates to draw information from the article and the question stem, and then to carry out a calculation. A number found this task challenging.

This answer gains both marks.

- (b) The bacterium *Mycoplasma* has the 'shortest known genome' (paragraph 13). This bacterium contains only 525 genes.

Calculate the mean number of bases per *Mycoplasma* gene.

Show your working.

(2)

525 genes.

580 000 pairs $\times 2 = 1160\ 000$ bases.

$$\frac{1160\ 000}{525} = 2209.523809. \rightarrow \text{round up (can't have half bases).}$$

2210.

Answer = 2210 bases



ResultsPlus Examiner Comments

The candidate has appreciated that there are 580 000 base pairs and this figure therefore needs to be doubled to produce the total number of bases in the *Mycoplasma* genome. The candidate has then carried out the correct calculation and produced the correct answer.

Question 7 (c) (i)

Many candidates showed a good understanding of what the differences are when constructing a stretch of DNA compared with a stretch of RNA.

This candidate's answer offered the most commonly awarded marking points to gain full marks.

(c) (i) Describe how 'building a stretch of DNA' would differ from 'building a stretch of RNA' (paragraph 21).

(3)

DNA is double chained in an α -helix, whereas RNA is single chained in a straight molecule.
DNA contains deoxyribose sugar whereas RNA contains ribose sugar.
DNA contains the base thymine whereas RNA does not, this is replaced with Uracil



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Examiner Comments

The first sentence suitably refers to marking point 4, whilst the second delivers marking point 1. The third sentence states the different bases used.



ResultsPlus

Examiner Tip

When being asked to consider differences, make sure you give both elements. For example, the bases needed to construct a stretch of DNA are adenine, thymine, guanine and cytosine but for RNA they are adenine, guanine, uracil and cytosine.

Question 7 (c) (ii)

A number of candidates found this item relating to a plasmid challenging.

This response would just gain the mark.

- (ii) Suggest why the scientists would 'insert the whole thing into a circular strand of DNA until they need it' (paragraph 21).

(1)

So that it is safely preserved preserved



ResultsPlus
Examiner Comments

This answer just fits the idea of less likely to degrade.

Question 7 (d)

Whilst the full mark range was seen for this 3 mark item about how three genes inhibit one another in sequence, only a minority scored all three marks.

This answer gains the most commonly awarded mark.

- (d) Suggest how 'three genes inhibited one another in sequence, their activity cycling regularly' (paragraph 26).

(3)

Activated genes result in protein production via the process of transcription then translation. These proteins may work by inhibiting the activation (deactivating) genes in cells thus stopping the ~~activation~~ corresponding protein synthesis. Inactive genes cannot produce their corresponding proteins.



ResultsPlus
Examiner Comments

The first sentence gains marking point 1 as it both refers to the gene product and its function. However, the second sentence does not convey the idea that the next gene in the sequence is inhibited.



ResultsPlus
Examiner Tip

It was very common to see answers that referred to one gene inhibiting another which is repeating the question. Make sure that you do not just repeat the question.

Question 7 (e)

This question required candidates to suggest the features of a metabolic pathway, in the context of bacteria converting nitrogen to ammonia. Whilst all marking points and marks were seen, relatively few achieved full marks.

This example shows one fairly typical answer. It was quite common to see comprehensive descriptions of the nitrogen cycle.

(e) A metabolic pathway is a many-stepped process.

Suggest the features of a metabolic pathway 'through which bacteria convert atmospheric nitrogen to ammonia' (paragraph 32).

(4)

the bacteria would use atmospheric nitrogen and synthesise it into amino acids, as nitrogen is used to make amino acids. The amino acids would then be folded into a specific shape and have specific bonds to create ammonia.



ResultsPlus
Examiner Comments

No marks worthy of credit are seen in this response.

Question 7 (f)

This question asked for two suggestions for features of a virus selected for a particular role. Whilst there were many pleasing responses, some candidates seemed to feel duty bound to list the identifying features of viruses.

This is a fairly typical response which gained 1 mark.

- (f) Weiss and his team are 'working to harness a virus that could be used to test the idea in mice' (paragraph 40).

Suggest **two** features of the virus selected for this role.

(2)

~~It must be able to tell the difference between a normal body cell & a cancerous cell:~~ It must not cause harm to the mouse by infecting a body cell (must not be pathogenic).
It must be able to infect the cells of mice / ~~not~~ not be destroyed by the mice immune system.



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Even without the additional material in the brackets, the description of not harming the mouse would have been a creditworthy example for marking point 1.

The second sentence is not sufficient for marking point 2.

For information, the crossed out sentence would have satisfied the marking point 2 criterion.

Question 7 (g)

The majority of candidates displayed a sound understanding of the functions of phase 1 testing, though it was not uncommon for candidates to refer to the testing being carried out on animals.

This candidate's answer gains two marks. Like many, it did not address the least commonly seen of the three marking points.

(g) After 'testing the idea in mice', phase 1 testing must be carried out (paragraph 40).

Explain why phase 1 testing must be carried out before using this treatment on a patient with cancer.

(3)

↪ They must make sure the drug doesn't have any harmful side effects on humans and that it is going to be effective. They test it on healthy humans to ensure there are no side effects. So it doesn't harm or make a cancer patient worse or ill.



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The first sentence refers to harmful side effects which is an acceptable alternative for marking point 2. The second sentence states that it is tested on healthy people which is marking point 1. However, no reference is made to establishing the dosage for marking point 3.

Question 7 (h)

The question item required candidates to offer descriptions of three differences between a stem cell and an insulin-producing cell. Whilst an encouraging number of complete answers were seen, several responses displayed inaccuracies. The example provided gives the most commonly seen inaccuracy.

This response gives two clear differences and an incorrect fact.

(h) 'Synthetic gene circuits could steer stem cells to develop into insulin-producing cells' (paragraph 41).

Describe **three** differences between a stem cell and an insulin-producing cell.

(3)

1. A stem cell is undifferentiated whereas an insulin-producing cell is differentiated.
2. A stem cell can be stimulated to produce any type of cell needed in the body whereas an insulin-producing cell cannot.
3. Stem cells are mostly found within bone marrow in the body whereas insulin-producing cells are found mostly in the liver.



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The first difference is marking point 2 whilst the second description of a difference is marking point 4. However, marking point 6 cannot be given as the candidate has referred to an incorrect location for the insulin-producing cells.

Question 7 (i)

A majority of candidates offered a mark worthy response to this item that required a suggestion for monitoring exposure to things like radiation.

A typical answer that gains the mark.

- (i) Suggest why it is necessary to 'keep track of exposure to things like radiation within a cell' (paragraph 45).

Radiation to cells can cause cancer. People ⁽¹⁾ working around radiation e.g. Radiotherapist, need to keep track of the amount of radiation they receive.



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The reference to 'can cause cancer' on the first line gains the mark.

Paper Summary

This unit includes synoptic aspects that cover more than one unit and it was most pleasing to see that many candidates were able to use their knowledge from across the subject to effectively tackle these question items. Likewise, it was gratifying to encounter many pleasing responses to the article.

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

- Read all the questions carefully, taking note of the command word in each case so that answers can be targeted accordingly
- Consider the mark allocation for each question item carefully
- When data is provided, make sure that it is used appropriately
- In questions that refer to variables that need to be controlled in investigations, do not repeat any variables that you have already been told are controlled.

Grade Boundaries

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