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June 2015

GCE Biology 6BI05 01

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Introduction

The 6BI05 exam paper offered candidates many opportunities to demonstrate their knowledge across a wide array of question styles and over a broad spread of the specification content. It also afforded candidates a number of opportunities to make connections from throughout the specification, as they approached various synoptic elements.

It was most encouraging to see candidates displaying good understanding of the material considered and many thanks should go to those who taught those candidates, as well as to the candidates themselves.

Whilst the number of illegible responses was pleasingly low and many item responses were written in a clear and unambiguous manner, some candidate answers could not be awarded marks due to their hand-writing or due to the quality of expression.

Question 1 (b) (i)

This item tested candidates' appreciation of when two different voltage-gate channels were closed and one open in a sensory neurone. Most candidates were able to achieve 1 mark and it was, perhaps, the first column that proved the most challenging for the candidates.

Question 1 (b) (iii)

This item requested candidates to describe structural differences between two types of myelinated neurone. There was a number of most pleasing and detailed descriptions.

This example displays the most commonly-offered correct response and achieved 1 mark.

(iii) Describe the differences in the structure of a myelinated sensory neurone and a myelinated motor neurone.

(3)

A ~~**~~ myelinated sensory neurone has the body cell / nucleus located around the centre of the neurone slightly separated, whereas in motor neurone it is located at the beginning.

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Examiner Comments

Unlike a number of responses, this answer offered a structural difference as requested.

This response gives a clear description of the position of the cell body in both the sensory and motor neurones, so marking point (mp) 4 could be awarded.

1 mark

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Examiner Tip

Make sure that, if the question asks for a structural comment, a structural comment is given. A functional comment will not gain the mark.

This example illustrates the most commonly-offered incorrect response.

(iii) Describe the differences in the structure of a myelinated sensory neurone and a myelinated motor neurone.

(3)

Both ~~are~~ myelinated sensory neurone and myelinated motor neurone cover by Schwann cells, ~~are~~ myelinated sensory neurone transport impulses ~~towards~~ towards body cell but myelinated motor ~~not~~ neurone transport impulses away from body cell (~~no~~ nucleus).

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Examiner Comments

This response illustrates how important it is to tailor an answer to the question being asked. Initially, the candidate refers to a similarity between the two neurone types. Then, a functional difference is offered.

As the question asked for structural differences, no marks could be awarded.

0 marks

Question 2 (a)

This item elicited the full mark range. It required candidates to explain how the SAN ensures oxygenated blood enters the aorta.

A number of candidates produced very clear, detailed and accurate answers, which were most heartening to read. However, it was not uncommon to encounter general descriptions of the cardiac cycle that did not focus on the details of the question. The question related to the SAN and specifically oxygenated blood entering the aorta.

This is a strong response, in a precise manner, which has achieved full marks.

2 A human heart can work effectively for over a hundred years but many people throughout the world have heart problems.

(a) Explain how the sinoatrial node (SAN) ensures that oxygenated blood enters the aorta.

(4)

The SAN is myogenic. It initiates an electrical impulse. This electrical impulse travels as a wave of depolarisation down the atria - causing atria systole. This pushes blood from atria into the ventricles, through the AV valve. A band of non-conducting fibres stops the depolarisation from travelling from SAN to Venoricles. The AVN is stimulated by the depolarisation from the AVN, this sends an electrical impulse down the bundle of His, to the Purkyne fibres. This causes a wave of depolarisation to travel from the apex of the heart up. This means ventricles contract from the apex up, forcing blood from the left ventricle through the semi-lunar valve, into the aorta.

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Examiner Comments

The response starts with a clear description of mp 1 on the first and second lines of the second sentence. The third sentence offers mp 2, precisely.

The answer goes on to give details of the AVN being stimulated by electrical activity from the SAN (mp 4) and then finishes off by referring appropriately to the left ventricle forcing oxygenated blood into the aorta (mp 5).

4 marks

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Examiner Tip

This answer has benefitted from being written in a logical sequence, such that important points are less likely to be missed. Try to offer answers that have a sequence, in a sequential manner.

Question 2 (b)

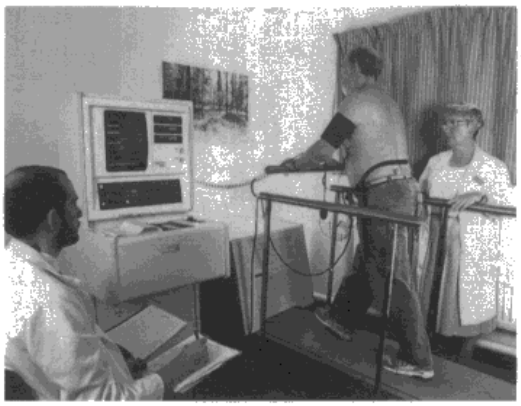
The emphasis of this *Quality of Written Communication* (QWC) item was on spelling and the majority of candidates dealt admirably with this aspect. The question required the candidates to consider how heart rate is controlled as the level of an exercise is increased. Many candidates had a most encouraging understanding of this area of the specification. However, some then felt the need to describe how a reduction in heart rate was controlled.

In addition to some candidates writing about the control of both increasing and decreasing heart rate, this response displays another regularly-seen addition - control of ventilation. However, it achieves a score of 1 mark.

*(b) The treadmill test can be used to diagnose heart problems.

This test requires a person to walk on a treadmill whilst an electrocardiogram (ECG) is recorded.

The angle of the treadmill is raised to increase the level of exercise. The photograph below shows a person carrying out the treadmill test.



d

Explain how the heart rate of this person is controlled as the level of exercise increases during this test.

(6)

- medulla oblongata control ~~breathing rate~~ heart rate
- Heart rate is increased.
- Heart beat faster per minute
- ~~cardiac~~ to transport more oxygen to muscle cell
- Motor cortex ~~to~~ and medulla ~~detect~~ send impulse ~~to the~~
- to medulla oblongate
- Receptor in the motor cortex and medulla detect increase in exercise
- medulla oblongata send impulse to ~~the~~ effector
- Effector ~~are the~~ in intercostal muscle ~~and~~
- Effector in diaphram
- Increase cardiac output

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Examiner Comments

This answer begins with a correct statement but one that is too general to be credit-worthy. It then refers correctly to the increase in heart rate (mp 10) but offers nothing, subsequently, that could be awarded a mark.

1 mark

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Examiner Tip

It may be worth highlighting the emphasis of the question on your exam paper (here, control of heart rate due to exercise), to reduce the likelihood of writing unrequired additional material.

This is a detailed, high-scoring response.

*(b) The treadmill test can be used to diagnose heart problems.

This test requires a person to walk on a treadmill whilst an electrocardiogram (ECG) is recorded.

The angle of the treadmill is raised to increase the level of exercise. The photograph below shows a person carrying out the treadmill test.

Explain how the heart rate of this person is controlled as the level of exercise increases during this test.

(6)

During exercise the amount of CO_2 in the body increases. This is detected by chemoreceptors in the carotid and aortic bodies. An impulse is sent to cardiovascular centre in the medulla, which sends an impulse down the sympathetic nerve to the SAN, it causes the SAN to generate electrical impulses at a faster rate. Heart rate can also be controlled by adrenaline, a chemical hormone. This acts directly on the SAN, increasing the heart rate in during exercise.

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Examiner Comments

Whilst this candidate answer gained 6 marks, mp 2 was not awarded on the first line because there was no reference to the increased carbon dioxide entering the blood.

The marks awarded, in sequence, are mp 4, mp 5, mp 6, mp 9, mp 11 and mp 10.

6 marks

Question 2 (c) (i)

This mathematical interpretation of an ECG proved challenging for a number of candidates, with only about a third gaining both marks. Perhaps the most common misinterpretation was the division of 74 (from the heart rate information provided) by the number of QRS waves seen on the trace.

Question 2 (c) (ii)

Rather less than half of the candidates offered appropriate units for the ECG vertical axis, although a number of candidates gave the units for the vertical axis of a spirometer trace.

Question 3 (a)

This question item required candidates to think about experimental design and How Science Works in the context of considering the sequence of how a procedure is performed.

This example shows one way that candidates tend to express mp 1.

3 An investigation was carried out to study the effect of positive and negative physical and emotional experiences on humans.

The positive physical experience was a warm object placed on the arm of a person for five seconds.

The negative physical experience was a hot object placed on the arm of a person for five seconds.

All other variables were kept constant.

Two groups of people were used in this investigation. In the first group, the warm object was used before the hot object. In the second group, the hot object was used before the warm object.

After each experience, the individuals were asked to rate their feelings using the scoring system below.

Feelings	Score
Very bad	1
Bad	2
Neutral	3
Good	4
Very good	5

(a) Suggest why one group had the warm object placed on their arm before the hot object and the other group had the hot object placed on their arm first.

(2)

To see if having one object first effected experience of the other object - eg. if the initial one made the second one a different experience. Both had to be tested to ~~eliminate~~ stop this effecting results in favour of one group

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Examiner Comments

This response achieved mp 1 only.

1 mark

Question 3 (b)

Candidates were required to use the data provided to consider the validity of a conclusion. Some candidates found this item challenging, perhaps because the similarity of the data made the conclusion valid.

The most commonly-achieved outcome was 2 marks.

This candidate response gives perhaps the three most frequently awarded mark points.

(b) These two groups were then exposed to a positive emotional experience and a negative emotional experience.

The mean results for the investigation are shown in the table below.

Experience	Mean score for feelings and standard deviation	
	Physical	Emotional
Positive	4.5 ± 0.5	4.2 ± 0.4
Negative	1.9 ± 0.6	1.7 ± 0.4

A student concluded that the physical experiences and emotional experiences were similar.

Using information in the table, comment on the validity of this conclusion.

(4)

~~For positive~~ For both positive and negative the mean score of feelings between physical and emotional experiences are very similair, for example for positive there is only a 0.3 difference in mean score and for negative (1.9 - 1.7) 0.2. ~~However there is~~ Also, the ~~range~~ standard deviation of both physical and emotional are similair for example for positive there is only a 0.1 difference. therefore the ~~stat~~ Student's conclusion is valid.

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Examiner Comments

The candidate states, early in the passage, mp 2. Then mp 5 and mp 1 are seen near the end.

3 marks

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Examiner Tip

Look to use data to its full extent. In this case, both horizontal comments about the mean data can be awarded (mp 2) as well as vertical comparisons between the difference in mean data (mp 3). Then appropriate comments relating to the standard deviation can be awarded.

This answer shows a type of response given by a minority of candidates.

(b) These two groups were then exposed to a positive emotional experience and a negative emotional experience.

The mean results for the investigation are shown in the table below.

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	Physical	Emotional
Positive	4.5 ± 0.5	4.2 ± 0.4
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A student concluded that the physical experiences and emotional experiences were similar.

Using information in the table, comment on the validity of this conclusion.

(4)

- The positive physical & emotional expenences had a higher mean score than the negative expenences.
- In the means scores there was only a 0·3 difference in the positive & a 0·2 difference in the negative.
- This suggests that they are similar, and there also wasn't a lot of differences in the standard deviation either. &
- However we don't know how long a gap there was between the groups being tested for the physical & emotional experiences, or what the emotional expenence was.
- ~~However~~ the conclusion isn't valid as it's also only one set of data.

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Examiner Comments

Towards the end of the passage the candidate has tried to consider the quality of the investigation and has come to the conclusion that it is not valid. However, the question required the candidate to judge the validity, based on the data provided.

The third bullet point offered by the candidate achieved mp 2 and mp 5.

2 marks

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Examiner Tip

Make sure that the instruction given is followed carefully.

Question 3 (c) (i)

It was pleasing to note that the vast majority of candidates appreciated that fMRI would be the most suitable scanning technique for this investigation. Many of these candidates were also able to offer a sensible reason. Fewer gave two appropriate reasons to support their choice.

This is a clear and focussed answer that achieved the full mark allocation.

(c) This investigation then used a scanning technique to study whether the same areas of the brain were involved in both physical experiences and emotional experiences.

(i) Suggest the scanning technique required to study the brain in this investigation. Give reasons for your choice.

(3)

fMRI must be used as this produces high resolution 3D images and also shows the brain activity. It does this by using radio waves. The active areas are shown as more oxygenated blood flows to the areas of the brain which are active/ being used during these experiences. It is also safer as it doesn't use x-rays.

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Examiner Comments

The candidate identifies the best scanning technique (mp 1) and then offers mp 5, mp 4 and mp 6.

Max 3 marks

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Examiner Tip

This candidate refers correctly to more oxygenated blood being directed to the active areas, rather than just oxygenated blood, which implies that the rest of the brain does not need any oxygen. Make sure the answer is unambiguous.

Question 4 (a)

This item required candidates to display their knowledge of rod cells. However, the context was rod cell behaviour in the dark after a period of light, and this confused some candidates. Others showcased a most impressive understanding of the subject matter and an ability to modify it to match the question approach.

This sound response was written in the context of the question and gained 3 marks. Two were gleaned from the most commonly-awarded points.

4 An investigation was carried out to study the effect of light on the mammalian retina.

Part of the retina of a young rat was removed and kept in the dark for two hours. This allowed the pigment in the rod cells to recover from bleaching caused by exposure to light.

(a) Suggest what happens in the rod cells during this two hours of darkness.

(5)

· During the two hours of darkness the rod cells are able to recover from bleaching. This means that the photoreceptor pigment : rhodopsin will be able to reform from bleaching. This means that the constituent parts : retinal and opsin will be able to bind back together (with the energy from ATP being split). In order for retinal to bind with opsin retinal must convert from trans back to cis form.

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Examiner Comments

The candidate initially achieved mp 3, closely followed by mp 4 and then, at the end, mp 2 was seen.

Mp 2, mp 3 and mp 6 were probably the most commonly-awarded marking points.

3 marks

Question 4 (b) (i)

Whilst this item was essentially a description of the trends seen in data relating to the effect of light intensity on mean peak voltage of bipolar neurone depolarisation, some candidates did not identify the light intensity range.

This response illustrates the importance of including the light intensity range and, as a consequence, only achieved 1 mark.

(i) Using the information in the table, describe the effect of light intensity on the mean peak voltage of depolarisation.

(2)

~~Light intensity~~ As light intensity increases so does mean peak voltage of depolarisation. The highest increase in mean peak voltage is from light intensity 1au to 3au causing ~~and~~ a 7mV increase in mean peak of depolarisation.

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Examiner Comments

The initial sentence suggests that this positive correlation occurs throughout the increasing light intensity range considered, when it only occurs up to 9 arbitrary units. As a consequence, mp 1 was not given.

However, the second sentence offered a good description of the non-linear increase, for mp 2.

1 mark

ResultsPlus
Examiner Tip

Make sure that descriptions of data are precise and that the independent variable range is quoted, as appropriate.

Question 4 (b) (ii)

The full spread of marks was seen in this item and about half of the candidature achieved 1 or 2 marks. Candidates were required to explain the effect of increasing light intensity on bipolar neurone depolarisation.

An encouraging answer that started in a manner seen frequently.

(ii) Suggest an explanation for the effect of light intensity on the mean peak voltage of depolarisation in these neurones.

(4)

- As light intensity is increasing more rhodopsin is being broken down, more of the Na^+ channels are being blocked. Less neurotransmitter is released and so less of the Na^+ channels of the bipolar cell are being blocked. More Na^+ can move into the bipolar cell, causing it to become more depolarised, causing the mean peak voltage of depolarisation to increase.

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Examiner Comments

Many responses started by describing rod cell behaviour. The first sentence of this response does this. It goes on to link increasing light intensity (1st line) with decreasing neurotransmitter released (lines 4 and 5) for mp 1. Then, the next sentence gains mp 2 and mp 3.

3 marks

Question 4 (c)

About two-thirds of candidates were able to offer two suitable reasons why some people would object to the use of rats in the investigation described in question (Q) 4.

This answer was typical of many and offers two of the most frequently-awarded marking points.

(c) Suggest **two** reasons why some people might have objections to the use of rats in this investigation.

(2)

Ethical issues such as the light may cause harm or damage the rats sight or the fact the rats cannot give consent.

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The reference to rats being harmed is a suitable alternative to mp 2 and the lack of consent is mp 1.

2 marks

Question 5 (a) (ii)

This item required candidates to explain why the coloured liquid in the respirometer did not move for the conditions described in the table. Most candidates were able to achieve one mark but only about one-fifth gained all 3 marks.

This answer gained 2 marks and illustrates the most common reason for not gaining full marks.

(ii) Explain why the coloured liquid did not move in investigation 1.

(3)

- no overall changes in gas ~~percentages~~ volume.
- ~~Anaerobic~~ Anaerobic respiration doesn't use oxygen.
- produces lactate not gases

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This candidate begins their answer with mp 3 and then suitably offers mp 1.

The candidate has also recognised that the animal tissue respiring anaerobically would produce lactate but has not made reference to the fact that no carbon dioxide would be released.

2 marks

This answer also gains 2 marks and illustrates another common way that candidates did not gain full marks.

(ii) Explain why the coloured liquid did not move in investigation 1.

(3)

As it was carrying out anaerobic respiration which doesn't use oxygen so the liquid would not move. Anaerobic respiration wouldn't release any CO_2 or intake any oxygen as it would instead produce lactate which wouldn't have any effect on the liquid, and it wouldn't move it.

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This candidate has recognised the substrate and product of anaerobic respiration in animal tissue but has not then linked this with no change in volume or pressure changes in the respirometer.

Mp 1 and mp 2 awarded.

Question 5 (a) (iii)

Many candidates were able to present detailed and accomplished responses to this item. They were required to describe the fate of reduced NAD in aerobic respiration.

This candidate has provided a complete answer that shows clear understanding of the material and has achieved the maximum of 4 marks.

(iii) Reduced NAD ($NADH + H^+$) would be formed in investigations 2 and 3.

Describe the fate of reduced NAD in aerobic respiration.

(4)

Reduced NAD moves to the mitochondrial inner membrane where the reduced NAD becomes oxidised. 2 electrons are transported along the electron transport chain. This is a series of carrier proteins in the membrane which are oxidised and reduced. The energy produced by this pushes H^+ ions into the intermembrane space which diffuse back through stalked particles allowing ATP production. the $2H^+$ and $2e^-$ go to attach to $\frac{1}{2} O_2$ molecule to form water. The NAD will be used again to transport more hydrogen from the krebs cycle to the electron transport chain.

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An answer that starts with the movement of the reduced NAD (mp 2) and its change to the oxidized form (mp 3) as it 'hands over' electrons to the electron transport chain (mp 4) and protons that are forced through into the intermembranal space (mp 5).

The final comment describes how the NAD is available again for the Kreb's cycle (mp 6).

Max = 4 marks

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Examiner Tip

Make sure that the response has sufficient points to match the mark allocation.

Question 5 (b)

Whilst there was a number of pleasing answers to this How Science Works question, many candidate responses would have benefitted from more detail.

This response achieves both marks but also illustrates a number of other salient points.

(b) Explain how investigation 3, shown in the table, could be used to compare the rate of respiration of two different tissues.

(2)

It could be set up twice with the same temperature (using water bath) and all variables kept the same including the mass of the two tissues. Each test tube is connected to a control which is kept with the same mass and size that do not respire. Set the coloured liquid to 0 using the syringe and leave for equal amount of time and measure the distance travelled by the liquid, whichever travelled further had the higher rate of respiration.

(Total for Question 5 = 11 marks)

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Examiner Comments

The candidate starts their response with a suggestion of keeping the temperature constant. However, this is not credit-worthy because earlier in Q5 it was stated that all variables were kept constant.

Subsequently, an appropriate reference to mp 1 is given. Of the two mark points, this was the point less commonly-encountered.

Towards the end of the passage, the candidate makes correct reference to distance and time, to gain mp 2. Frequently, candidates did not include a time reference for mp 2.

2 marks

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Examiner Tip

Check the description of the investigation carefully, to make sure of the detail - such as which variables are already being controlled.

Question 6 (a)

This item required candidates to suggest why EPO would provide little benefit to a sprinter's performance. Whilst the full mark range was seen, many candidates achieved 2 marks, rather than 3.

This response offers the most commonly-cited awarded mark.

6 A number of drugs, including EPO, have been used by athletes.

EPO is a drug that stimulates the formation of red blood cells. EPO has been used to enhance the performance of certain types of athlete.

(a) Sprinters usually have more fast twitch fibres in their leg muscles than long distance runners.

Suggest why EPO may have less of an effect on the performance of a sprinter than on a long distance runner.

(3)

There are less capillaries surrounding fast-twitch fibres. Fast-twitch fibres have less myoglobin and haemoglobin that stores oxygen. Fast-twitch fibres make up most of a sprinter's leg muscles. Furthermore, anaerobic respiration is the dominant type of respiration during a sprint.

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Examiner Comments

The first sentence was insufficient for mp 4 but the final sentence referred suitably to anaerobic respiration for the award of mp 5.

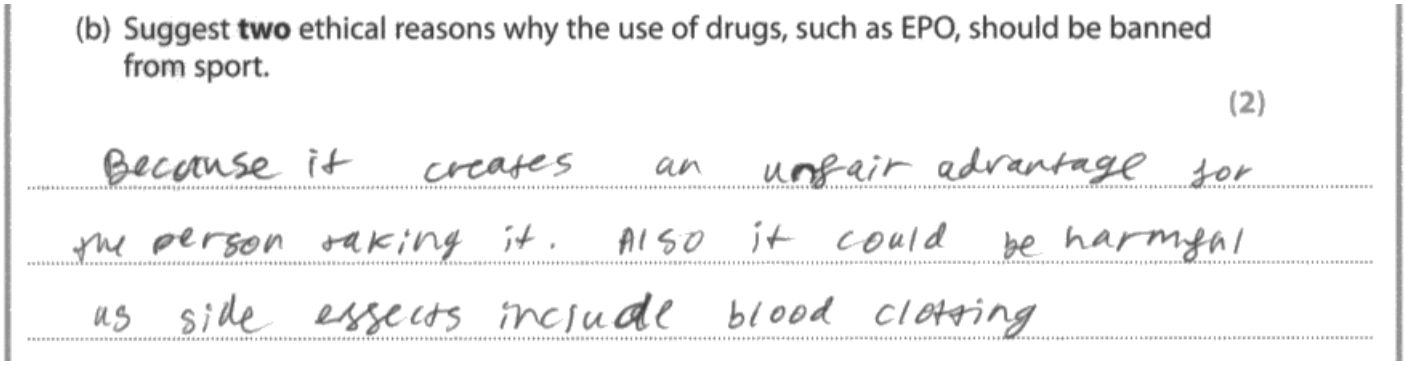
1 mark

Question 6 (b)

The majority of candidates delivered clear and precise responses to this item about why drugs such as EPO should be banned from sport.

This response is representative of many answers seen and gained both marks.

2 marks



(b) Suggest **two** ethical reasons why the use of drugs, such as EPO, should be banned from sport.

(2)

Because it creates an unfair advantage for the person taking it. Also it could be harmful as side effects include blood clotting

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Examiner Comments

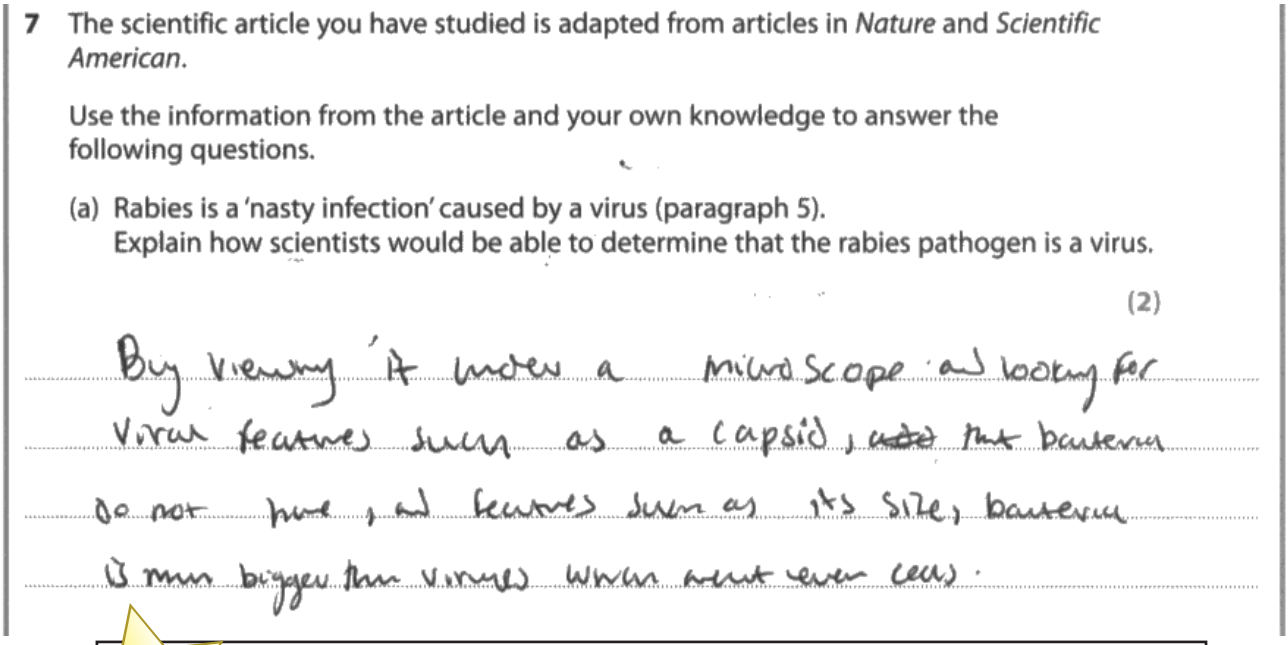
The candidate scores mp 1 and mp 3. In the latter case, the candidate has not only referred to potential harm but also has given an example.

2 marks

Question 7 (a)

This first item of Q7 required candidates to explain how scientists could determine that a named pathogen was a virus. It proved discriminating for a variety of reasons.

This is a clear answer, which elicits both marks.



7 The scientific article you have studied is adapted from articles in *Nature* and *Scientific American*.

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

(a) Rabies is a 'nasty infection' caused by a virus (paragraph 5).
Explain how scientists would be able to determine that the rabies pathogen is a virus.

(2)

By viewing it under a microscope and looking for virus features such as a capsid, ~~and~~ but bacteria do not have, and features such as its size, bacteria is much bigger than viruses which aren't even cells.

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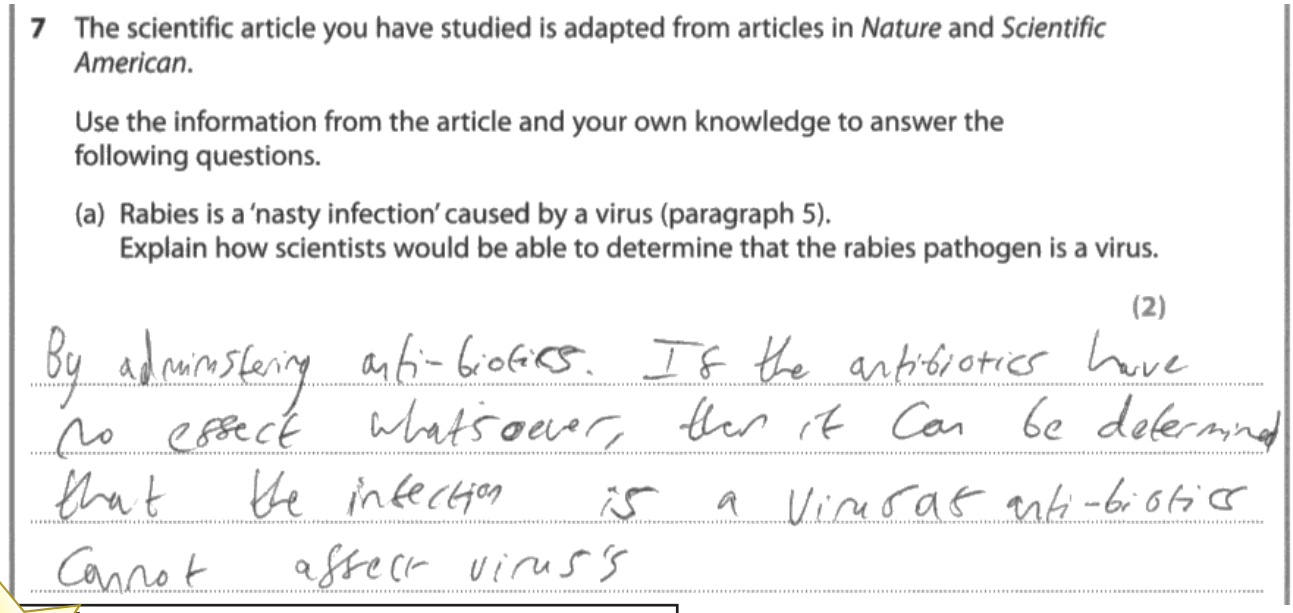
This candidate has gained both marks through being awarded mp 1 and mp 4.

2 marks

This answer shows a commonly-offered response that was not credit-worthy.



7 The scientific article you have studied is adapted from articles in *Nature* and *Scientific American*.

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

(a) Rabies is a 'nasty infection' caused by a virus (paragraph 5).
Explain how scientists would be able to determine that the rabies pathogen is a virus.

(2)

By administering anti-biotics. If the antibiotics have no effect whatsoever, then it can be determined that the infection is a virus as anti-biotics cannot affect virus's

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It appears that this candidate may be suggesting how to show that the pathogen is not a bacterium, which was not the point of question.

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Examiner Tip

Check carefully the focus of the question.

Question 7 (b)

This is the second QWC item in the paper. The focus was on the clarity of expression in a candidate's response. The item required the candidates to suggest how scientists genetically modified the pathogen so that it would elicit an effective immune response in the host organism.

The mark allocation was 6 marks and the whole range was seen. Likewise, all marking points were seen.

This response offers a slightly confused account, which did not achieve any marks.

*(b) Suggest how researchers had genetically modified the pathogen to 'provoke an effective immune response' (paragraph 12).

(6)

The researches ~~took~~ using an enzyme extracted the gene that codes for a specific immune response and copied it using PCR. Once the gene had been copied many times, a plasmid was cut using an enzyme and the gene inserted. Once the plasmid has the gene, it is inserted into the pathogen where it is then transcribed and translated (copied) many times until eventually the gene that codes for the specific immune response is present in every cell of the pathogen, therefore meaning it has been genetically modified to have an immune response.

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The initial comment about a gene coding for a specific immune response is not quite equivalent to mp 1.

The reference to an enzyme extracting this gene has not been named, so the response does not merit mp 2.

The description of transcription and translation seems to relate to the copying of a modified plasmid, rather than the production of a gene product - so the response does not merit mp 2.

0 marks

Question 7 (c)

This item enabled candidates to suggest ways that the compound reactivated certain neurotransmitter receptors. Many candidates offered sound suggestions and many achieved 1 mark of the 2 available.

This is a strong, focussed and clear answer that gains both marks.

(c) Octopamine is a neurotransmitter (paragraph 24). Libersat and his team believe that wasp venom probably blocks octopamine receptors in the central nervous system of the cockroach.

Suggest **two** ways that the 'compound that reactivates octopamine receptors' (paragraph 25) could work.

(2)

- Could be a enzyme that beaks down the wasp venom and causes it to leave the octopamine receptors.

- Can be a compound that binds onto the wasp venom. This change in shape causes it to leave the receptor, leaving the receptor available to the neurotransmitter

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Examiner Comments

This response achieves the maximum of 2 marks by offering mp 4 on the first line and mp 2 by the end of the second line.

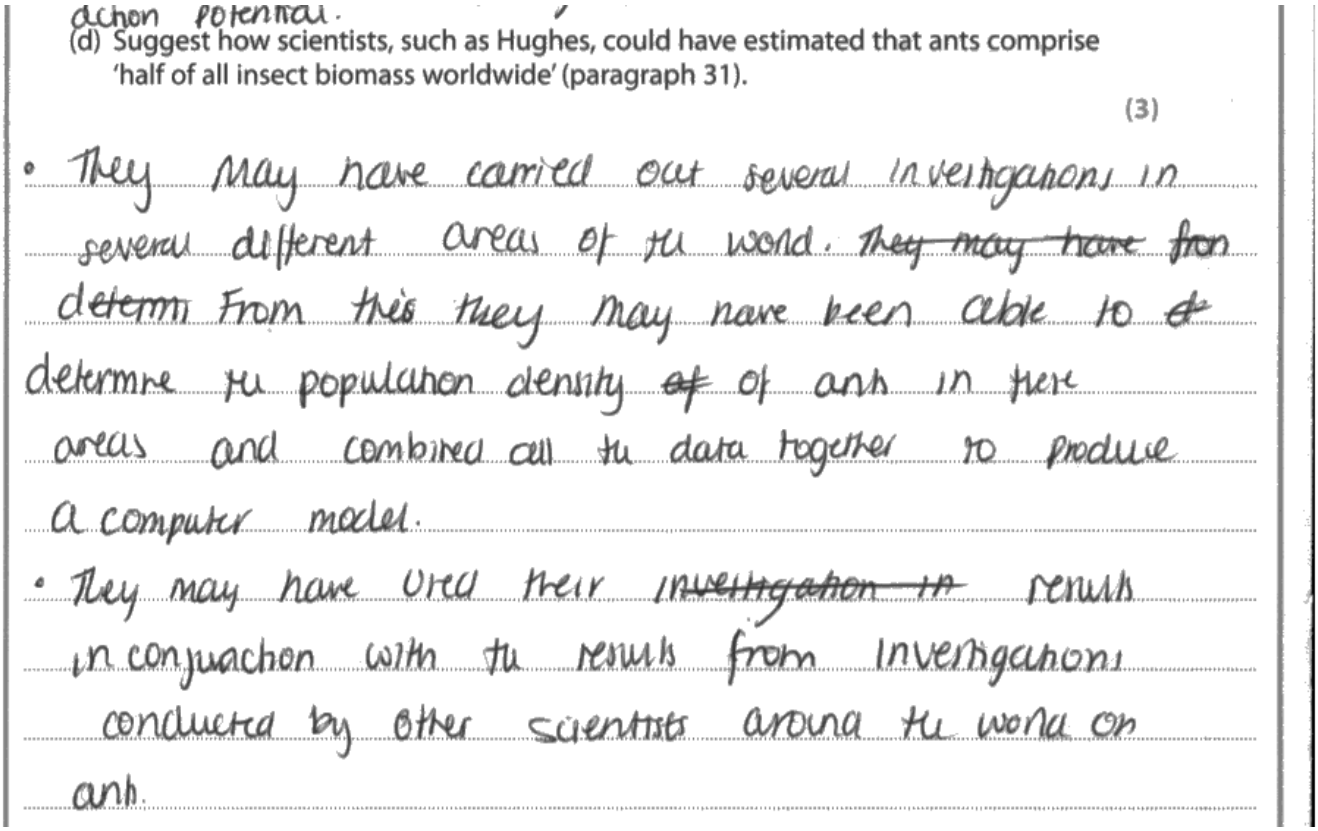
The second bullet point would have been mp 1.

Max = 2 marks

Question 7 (d)

Candidates were expected to suggest how scientists could have made a global estimate of the relative biomass of ants compared with the full insect biomass. The full mark range was seen, with a number of excellent suggestions proffered.

This candidate has offered the most commonly-seen mark and was awarded 1 mark.



action potential.

(d) Suggest how scientists, such as Hughes, could have estimated that ants comprise 'half of all insect biomass worldwide' (paragraph 31).

(3)

- They May have carried out several investigations in several different areas of the word. ~~They may have from~~ determ From this they may have been able to ~~d~~ determine the population density ~~of~~ of ants in these areas and combined all the data together to produce a computer model.
- They may have used their ~~investigation in~~ results in conjuaction with the results from investigations conducted by other scientists around the world on ants.

ResultsPlus
Examiner Comments

The first sentence is an equivalent to mp 3.

1 mark

Question 7 (e)

In this question, candidates had to suggest how genes from the fungal parasite may be expressed and affect the behaviour of their host. The full mark range was seen and the spread was even across this range.

This response was too general to gain any marks and illustrates a regularly-encountered comment.

(e) 'While the manipulated individual may look like an ant, it represents a fungal genome expressing fungal behaviour through the body of an ant' (paragraph 33).

Suggest how fungal genes may be expressed and affect the behaviour of these ants.

(5)

- The fungal genes would replace the ant genes which would change the genotype in the ant and also the phenotype.
- This means that the ants would act different because genes code for certain behaviours.
- If the ants have fungal genes they would act in the way that ~~fungus~~ the fungus would act

ResultsPlus
Examiner Comments

The reference to ant behaviour being different is too general for mp 7. The question stem refers to the ant behaviour changing and the article, particularly paragraphs 32 to 35, gives descriptions of the behavioural changes.

0 marks

ResultsPlus
Examiner Tip

Make good and appropriate use of the article.

This response considers both the expression of the fungal genes and how the product may cause the behaviour changes in the ant. The response was worthy of all five marks.

(e) 'While the manipulated individual may look like an ant, it represents a fungal genome expressing fungal behaviour through the body of an ant' (paragraph 33).

Suggest how fungal genes may be expressed and affect the behaviour of these ants.

(5)

Fungal genes would be expressed through differential gene expression. The fungal cells that infect the ant would have certain genes switched on that would code for protein (such as hormones and enzymes). These genes would be transcribed onto a strand of mRNA and would be translated by tRNA where a strand of the protein would be made by the ribosome. This protein would then fold in the ~~smooth~~ rough endoplasmic reticulum and be modified (through the addition of carbohydrate chains) in the golgi apparatus. After this the proteins would be released into the ant through exocytosis, where they could then infect other cells in the ant and cause hard-wired alterations in the genome of the ant cells by modifying its DNA as transcription factors or the protein could travel to the brain as hormones and block receptors or neurotransmitters in certain areas of the brain preventing certain functions.

ResultsPlus
Examiner Comments

This answer was awarded mps 2, 5, 4, 6 and 8.

5 marks

Question 7 (f)

Candidates were asked to suggest the meaning of the term 'clock genes' and the majority was able to achieve 1 mark.

This answer nicely illustrates the approach taken by many candidates.

(f) Suggest what is meant by the term **clock genes** (paragraph 35).

(2)

Genes that become switched on and code for proteins at a specific time or time interval.

ResultsPlus
Examiner Comments

This response refers appropriately to the role of a certain time of the day in activating the gene, and so gained mp 2. However, like many, it did not consider what was meant by the term *gene*.

1 mark

ResultsPlus
Examiner Tip

When presented with a phrase to explain, make sure that the whole of the phrase is considered.

Question 7 (g)

Candidates were required to suggest how a lack of signals, as referenced in the article, would lead to muscle atrophy. This 4-mark item elicited the full mark range with the majority of candidates achieving 2 marks.

This is a good answer that gains full marks.

(g) Suggest how a lack of 'signals' (paragraph 36) could lead to muscle atrophy.

(4)

A lack of signal means that the Ca^+ ions from the sarcoplasmic reticulum do not reach the ~~sarcomere~~ sarcoplasm and so they can not bind to tropanin. As a result, the shape of tropanin does not change and so does not pull of tropomyosin. Because of this, the myosin binding sites are not exposed on the actin filament, and so actomyosin bridges can not form. As a result, the muscle deteriorates and may ~~be~~ stop moving.

ResultsPlus
Examiner Comments

The candidate has started their response by stating that the signals are indeed calcium ions. The context of the answer is the effect, due to a reduction in calcium ion presence, so mp 1, mp 2, mp 3 and mp 5 can be awarded.

4 marks

This response shows a fairly commonly-seen error. However, 1 mark can be awarded.

(g) Suggest how a lack of 'signals' (paragraph 36) could lead to muscle atrophy.

(4)

The cerebellum sends impulses down motor neurones to muscles which causes them to contract, this leads to movement. Fewer impulses down motor neurones means fewer action potentials are created. This means impulses aren't able to pass to muscles so muscles don't contract at all, leading to muscle atrophy.

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Examiner Comments

The candidate has, incorrectly, considered that the signals referenced in the article are nerve impulses, rather than calcium ions. However, the candidate does state that this leads to a reduction in muscle contraction, which is an alternative for mp 4.

1 mark

Question 7 (h)

Many candidates offered encouraging and appropriate examples of how the scientists could have identified the fungi as different species.

Question 7 (i)

Most candidates were able to offer at least one suggested advantage to the parasitic fungus of the altered ant behaviour.

This response gains 1 mark, the most commonly-achieved score for this item.

(i) There is evidence showing that ants parasitised by the fungus bite the main veins of leaves (paragraphs 35 and 47).

Suggest the advantages to the zombie fungus of this ant behaviour.

(2)

The main veins of the leaf are strong as supported by cellulose fibres. By holding here the ant is more likley to be supported even after death. The vein is structurally strong so won't break off easilly and drop ant, or heavy fungus as it grows.

ResultsPlus
Examiner Comments

Mp 2 was seen, and awarded, here.

1 mark

Paper Summary

Whilst a host of pleasing responses was presented by candidates for this 6BI05/01 paper, based on their performance on this paper, candidates are offered the following advice.

- Careful reading of the question is imperative: a number of candidates offered answers that did not fully match the question
- Look to make full use of numerical data when supplied, such as manipulating it
- Use the mark allocation as a guide to the level of detail required in a response
- Make sure that consideration is given to the article, particularly as a third of the paper marks relate to this
- Read through your answers, time permitting, to make sure that they are unambiguous and legible

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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