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Examiners' Report
June 2010

GCE Biology 6BI05

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Introduction

The performance of candidates at the first sitting of this paper was encouraging. Good answers were seen for all of the questions and it was clear that many candidates had prepared well for questions relating to the pre-released article and were able to draw on knowledge from other units for synoptic questions. By contrast, it was obvious when a candidate had not paid sufficient attention to preparation of synoptic material. Throughout the paper candidates frequently lost credit due to a lack of clarity of expression and a failure to use the context given in the question. There was evidence that some candidates were unaware of the criteria for quality of written expression in those questions marked with an asterisk, and responses were often far too long as a result of a lack of focus on the actual question. Very long answers are unlikely to be appropriate where two marks are available, for example, and candidates should be encouraged to select only relevant information. As seems inevitable, a significant number of responses showed that the candidate had not read the question sufficiently carefully and credit was lost as a result. A number of questions allowed candidates to show a thorough understanding of biological processes and score well, although some misconceptions were surprisingly widespread. Questions requiring application of understanding tended to be less well done, and these allowed better candidates to show themselves. In particular there were a number of superficial answers to questions relating to the article where a much deeper understanding is required. Candidates should be aware that only some of the answers are to be found in the text and that most often they should be looking for links to knowledge they already have.

Question 1(a)

Candidates generally had little difficulty with most parts of this straightforward opening question. Those who were familiar with the specimen materials were probably very well prepared, and the most common issue was with candidates giving longer answers that necessary to score full marks, wasting valuable time.

The majority of candidates scored both marks for references to the size and location of the abnormality.

Poor answers often restated the question and explained that the scan would be useful in determining the best treatment or made suggestions about the nature of the abnormalities shown without using the appropriate context.

(a) Describe how these images could help a doctor to determine appropriate treatment of the abnormalities.

(2)

Because the diagrams show clearly the ~~areas~~ damaged ~~which~~ areas. Hence a doctor can ~~determine~~ appropriate treatments for these abnormalities

ResultsPlus
Examiner Comments

This response restates the question in the second sentence.

ResultsPlus
Examiner Tip

Write the answer, not the question.

Even good answers can be wasteful of effort and time.

(a) Describe how these images could help a doctor to determine appropriate treatment of the abnormalities.

(2)

These images can show the location and size of the abnormal areas in the brain and decide what treatment is appropriate in order to cure the abnormalities.

ResultsPlus
Examiner Comments

This response scores full marks in the first line, There is no need to fill space.

Question 1(b)

Most candidates scored the obvious points for linking the different locations of the abnormalities with different regions of the brain having different functions.

Question 1(c)

Rather too many candidates seemed to read this question as asking how fMRI works rather than how it is used. As a consequence, all of the space was often used before anything relevant was given and this was a very good example of candidates being unable to focus on the question asked. Poor expression was rife and it was common for responses to consider just oxygenated blood, which is common in all arteries, without reference to differences in blood flow.

The important link between activity or stimuli and changes in blood flow was often lost in the attempt to explain how oxygenation could be detected, and where it was made there were many references to the active parts of the brain lighting up without any sensible qualification.

(c) Describe how fMRI is used to investigate brain function.

(2)

fMRI monitors the uptake of oxygen in different brain areas. Radio waves are absorbed by deoxyhaemoglobin but are not absorbed by oxyhaemoglobin so active areas of the brain light up on the images produced.

ResultsPlus
Examiner Comments

No explanation of what is meant by 'lighting up' means that credit cannot be gained.

Question 2(a)

This was a very straightforward examination of understanding of the nerve impulse and it was pleasing to see many good responses. Misconceptions regarding the establishment of the resting potential were disturbingly common, however, and reference to sodium or potassium without mention of ions was seen regularly. Descriptions of ions moving into or out of a membrane were penalised where it was not clear that the ions were crossing the membrane.

The majority of candidates scored marks for describing the opening of sodium gates and the movement of sodium ions. Errors were occasionally made with regard to the direction of the ion movement, and ions were incorrectly described as moving into the membrane.

(a) Describe the events that begin the depolarisation of the membrane of a neurone.

(2)

Arrival of a stimulus causes sodium channels to open and sodium diffuses into the membrane down the concentration gradient. If threshold potential is reached more sodium channels open and more sodium diffuses in causing depolarisation of the membrane

ResultsPlus
Examiner Comments

This candidate has made two common errors, describing the diffusion of sodium and that it diffuses into the membrane.

ResultsPlus
Examiner Tip

Be precise in descriptions. If the particles are ions you should say so.

Question 2(c)

Correct reference to the changes in the state of sodium and potassium gates gave two marks to many candidates, but it was surprisingly uncommon for a further description of the change in permeability to potassium ions or the relevant gradients to yield the final mark. Candidates should be discouraged from simply stating terms where the question requires an explanation. Although repolarisation was underway at the point specified on the diagram, simply naming the process did not gain credit.

Question 2(d)

This question was not well answered by many candidates and it is evident that the mechanism by which the resting potential is restored following an action potential is not well understood. A startling number of candidates were confident that the sodium/potassium pump is responsible for repolarisation, which clearly did not gain credit, and there were very few clear descriptions of potassium ions following an electrochemical gradient following hyperpolarisation.

This response is typical of a number of candidates.

(d) Explain how the potential difference across the membrane is returned to the resting level in the time between 1.5 ms and 4.0 ms on the diagram.

(3)

This is known as the refractory period, and occurs because potassium ion pumps are slow to close and allow hyperpolarisation. The ~~diffusion~~ process of the sodium potassium pump causes the difference across the membrane to be returned to its resting potential as well as the ~~diffusion of sodium ion through channels~~

(Total for Question 2 = 10 marks)

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Examiner Comments

The first sentence is irrelevant to restoring resting potential but typical of candidates feeling the need to set a scene. The reference to the sodium potassium pump was seen frequently but is clearly not worth credit.

ResultsPlus
Examiner Tip

You can assume that the examiner knows how your answer will fit into the full story. Just answer the question.

Question 3(a)

It is important that candidates realise the importance of not only carrying out core practical work but also understanding what they are doing. The experiment described in this question should have been familiar to candidates, and it was quite obvious when it was not, so the majority of the marks were aimed at testing the How Science Works statements about experimental design. It was particularly disappointing when candidates appeared unfamiliar with the apparatus, but more common were responses showing a lack of understanding of controlled variables and validity.

Only a very basic understanding of how the experiment works was required for two marks, but this was not evident in a significant number of responses. Many descriptions of the toxicity of carbon dioxide were seen as well as vague suggestions that it would cause photosynthesis to increase. Many responses were concerned that the 'results would be affected' without any explanation of how. Candidates should be encouraged to be more precise in their expression and realise that such phrases are unlikely to be worthy of credit at this level. Similarly, an 'amount' of a gas is much less accurate than a volume or pressure.

Candidates commonly missed important aspects of experiemntal design.

(a) Suggest reasons for absorbing carbon dioxide in this apparatus.

(2)

It CO_2 is a product of respiration. When it is absorbed it is removed from the air, reducing the pressure, resulting in the coloured liquid moving along. The movement can be measured easily.

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Examiner Comments

The first two sentences express credit worthy points well, but the answer crucially lacks any reference to measuement of oxygen uptake.

Question 3(b)(i)

This proved to be a very easy calculation for many with the most common error being answers given per hour or as an average per fifteen minutes. Careful reading of the units given and required would have avoided this.

Question 3(b)(ii)

Many candidates scored well by giving the simple answer that oxygen was unavailable and hence there would be no change in the pressure or volume within the apparatus. There were, however, responses suggesting that germinating seeds do not need to respire and some long explanations as to why they do not absorb nitrogen. It was disappointing that more candidates could not make the link to anaerobic respiration in the absence of oxygen.

Candidates felt the need to explain answers in terms of the presence of nitrogen rather than the absence of oxygen.

(ii) The seeds in the experiment with nitrogen gas continued to germinate.
Suggest an explanation for the lack of movement of the liquid.

(2)

Respiration was not taking place due to lack of oxygen. However photosynthesis could still take place, ~~which~~ with presence of CO_2 and light. Nitrogen is used to make proteins in plants.

ResultsPlus

Examiner Comments

Three common issues are illustrated here. The incorrect assumption that seeds are photosynthesising, no appreciation that anaerobic respiration is a possibility and some reason why plants might need nitrogen.

A good answer that easily gains full marks.

(ii) The seeds in the experiment with nitrogen gas continued to germinate. Suggest an explanation for the lack of movement of the liquid.

(2)

The seeds are germinating anaerobically, ~~so the~~ ~~aren't~~ ~~u~~ because there is no oxygen in the air. The waste product is carbon dioxide, which is absorbed by the soda lime, so there is no net change in the ~~colour~~ gas pressure.

ResultsPlus

Examiner Comments

The only improvement here would be to make explicit the fact that anaerobic respiration does not require oxygen.

Question 3(b)(iii)

This question in particular illustrated that candidates need to be given more opportunities to develop their understanding of the terms used to describe experimental design. Validity was not well understood and many candidates suggested that comparing the rate of respiration in seeds and insects is not valid because they are different species or have different levels of activity. While such a comparison may not be particularly useful, it can be valid. Where candidates did see the flaws in the design they often lost credit by suggesting that the same 'amount' or 'number' of organisms should be used. Candidates should also be advised not to use 'similar' when 'same' is more appropriate.

This was a typical case of misunderstanding the point of the investigation.

(ii) The seeds in the experiment with nitrogen gas continued to germinate. Suggest an explanation for the lack of movement of the liquid.

(2)

Respiration was not taking place due to lack of oxygen. However photosynthesis could still take place, ~~seeds~~ with presence of CO_2 and light. Nitrogen is used to make proteins in plants.

ResultsPlus

Examiner Comments

The investigation is trying to establish whether different organisms have different respiration rates so this cannot be worth credit. Reference to 'amounts' will not be credited in this context.

ResultsPlus

Examiner Tip

Know how the core practical investigations work and how good experimental design can be achieved.

Question 4(a)

The majority of candidates were able to describe the fact that the SAN initiates a heartbeat although the use of the term pacemaker without any explanation was not sufficient to gain credit.

This is typical of a vague answer.

4 Electrical activity in heartbeats can be recorded using electrocardiograms (ECG). An ECG includes recording of the activity of the sinoatrial node (SAN).

(a) Describe the role of the SAN in controlling heartbeats.

(2)

- Act as a pacemaker
- Sets the rhythm of heart bead.

ResultsPlus
Examiner Comments

Without further explanation, 'pacemaker' will not be worth credit and the remainder of the response is too imprecise.

Question 4(b)

This was an example of where candidates found it difficult to focus on the question asked. Many responses described at length how the cardiovascular centre could be affected by a range of factors before moving on to talk about its effect on the SAN. Candidates should be advised to avoid using terms such as 'message' or 'signal' when discussing nervous communication at this level, and it is preferable to consider changes in the frequency of impulses rather than suggesting that 'an impulse' is responsible for changing the heart rate.

This response scores full marks but illustrates how time can be wasted.

(b) Describe how the cardiovascular centre, in the medulla oblongata, affects the SAN during exercise.

(2)

The cardiovascular centre detects a fall in pH of the blood due to chemoreceptors and stretch receptors and sends an impulse through the sympathetic nerve to the SAN to increase heart rate.

ResultsPlus

Examiner Comments

Most of the first three lines is not worthy of credit, and the misconception that 'an impulse' is sent is shown. Both marks are gained in the final line.

Question 4(c)

Where candidates used the information given they often scored well by describing the differences between the ECGs and the measurements of pressure in the pulmonary artery. Good candidates often suggested that the ventricles were unable to contract or that the contraction was ineffective. Time was sometimes wasted by going on to describe the effect of ectopic beats on health.

Question 4(d)

It was common to find candidates giving an opinion on the use of performance-enhancing drugs and just one reason to back it up. It is very unlikely that credit will be available for choosing a standpoint and so two relevant points must be made to score both marks.

(d) Performance-enhancing drugs may affect heart activity. Outline **one** ethical position relating to whether these drugs should be banned.

(2)

performance-enhancing drugs should be banned because they can cause harmful side effects to athlete; which they may be unaware of. Drugs cause an unfair advantage which is unnatural; athletes may be pressured into drug taking

(Total for Question 4 = 11 marks)

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Examiner Comments

This candidate scored both marks by expanding the answer to include more than one reason to support a point of view.

ResultsPlus
Examiner Tip

Match the number of relevant points to the number of marks available.

Question 5(a)

It seemed that a significant number of candidates felt that only one muscle of a pair can be contracted at any time and there was little appreciation that holding a position requires muscles to contract in opposition.

Question 5(c)

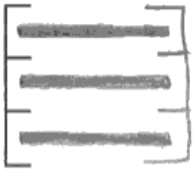
Poor expression lost marks for many candidates in this question and the most common answer involved some aspect of muscles being either contracted or relaxed. Few went on to explain that an antagonist is needed to extend a muscle, and those that did tended to write in terms of pulling and pushing, with even fewer able to explain the significance in terms of control of position.

Question 5(d)

Most drawings were correct in shortening the sarcomere and many were done well, but attention should be drawn to words such as 'accurately' in questions. An important aspect of the sliding filament theory is that filaments do not change in length, so any suspicion that the drawing did not reflect this was penalised. Often, the myosin filament was drawn much thicker than the original, and this also lost credit.

Complete the diagram below to show accurately the arrangement of actin and myosin when the muscle is contracted.

(3)



ResultsPlus
Examiner Comments

Marks were lost in this case for shorter actin filaments and no clear increase in the overlap. The thick myosin filament is not terribly accurate either.

ResultsPlus
Examiner Tip

Where an accurate drawing is required you should be as accurate as possible. Using a ruler for drawing and measuring is allowed.

Question 5(e)

The incidence of detailed knowledge of the process of contraction was very impressive and candidates were able to tell the story with great clarity. For the most part candidates did relate their answer to the question and focused on calcium ions and ATP. A few ignored the asterisk marking this as testing QWC and wrote in bullet points.

Question 6(b)

Candidates generally seemed very confident with chemiosmosis, and there were many good accounts of the process that scored well. The movement of hydrogen ions and electrons was well explained for the most part, although there was sometimes confusion about where they were going and the involvement of ions as opposed to atoms was not appreciated by some.

Question 7(a)

The format of this last question will have been more familiar to some than to others, since something very similar was a part of the Salter's-Nuffield course. It is an opportunity for candidates to show that they can study and comprehend real scientific writing and so much of the important work is done in advance of the examination. Identifying synoptic links within the text is a particularly useful exercise as candidates can come to appreciate the range of biological knowledge that can have a bearing on a topic and material from any part of the course may be required in questions. Although there will be a need to locate information in the text during the examination, the intention is to test knowledge and understanding and not to act as a simple comprehension exercise. Where possible, candidates will be directed to the part of the text providing the context.

Relevant material was often pinpointed, but it was equally very obvious when a candidate was meeting a term for the first time in the examination as they did not appear to have time to locate it and understand the context. There was much evidence of clear understanding of the article, and many successfully showed that they appreciated the links to the specification. Questions that require candidates to gather information from throughout the text are likely to occur as a test of whether the candidate has studied and understood the scientific writing, and this will be difficult for those who are not very familiar with the content.

Where candidates appreciated that it was more enzyme that was being produced, and that enzymes are proteins, they scored very well. Clearly, knowledge of protein synthesis is secure among the majority. A significant number, however, described how more neurotransmitter might be made and could not, therefore, access the mark scheme. Once again, candidates should be encouraged to look carefully at the requirements of the question – in this case an outline was required, with four marks available, so only the main points need to be given.

7 The scientific document you have studied is adapted from articles in New Scientist. Use the information from the article and your knowledge to answer the following questions.

(a) Outline the process by which 'more molecules of the enzymes' are produced (last paragraph on page 7).

(4)

More enzymes are produced due to increased protein synthesis. The process is transcription and translation. A gene is switched on, then is transcribed into mRNA, then translated into a sequence of amino acids, which code to form a protein. So ~~increased~~ faster transcription and translation mean that more ~~mole~~ molecules of the enzymes are produced.

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Examiner Comments

This response clearly makes the link between enzymes and proteins and then moves on to score full marks by outlining the main stages of protein synthesis.

7 The scientific document you have studied is adapted from articles in New Scientist. Use the information from the article and your knowledge to answer the following questions.

(a) Outline the process by which 'more molecules of the enzymes' are produced (last paragraph on page 7).

(4)

The molecules of the enzymes are produced when noradrenaline binds to to- adrenoreceptors of a neuron where the cell produces more cyclic AMP. This regulates the synthesis & release of neurotransmitters such as noradrenaline, increasing its enzymes & therefore its synthesis. The more noradrenaline released, the more is produced.

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Examiner Comments

By contrast, this response has tried to use material from the text without any real explanation of how it is relevant to the enzyme molecules.

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Examiner Tip

You will be expected to answer from your own knowledge in some questions on the scientific article.

Question 7(b)

It was hoped that candidates would be able to demonstrate their understanding of the nature of the fluid mosaic model of membrane structure, but many struggled to express their ideas clearly. Some fairly easy marks were available for appreciating that the fluidity of the phospholipid bilayer makes it possible to insert or remove adrenoceptors, which are proteins, and many scored marks for making at least one of those points.

Question 7(c)

This was one of the more obvious attempts to assess understanding of How Science Works, and most candidates were able to find conflict in the text and gain credit. The number of responses making more general points was very limited, however, and the notion that scientific models are tentative was not well expressed.

This was a reasonable answer that made a general point and found a supporting example.

(c) Explain, using examples from the text, how scientific opinion can be 'deeply divided' when based on the same evidence.

(3)

Some scientists believe noradrenaline is in itself directly responsible for stress & its harmful emotional affects. However, other studies contradict this & have found that injecting noradrenaline into certain regions of the brain can prevent the symptoms of stress - proves clearly that scientists can draw different conclusions from the same evidence

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Examiner Comments

Many candidates found the contradictory evidence from noradrenaline studies, but surprising few went on to make the point that different conclusions can be reached from the same observations.

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Examiner Tip

Give more than one example if the question invites it.

Question 7(d)(i)

Questions of this nature are likely to be a feature of this paper for reasons explained earlier and in this case it proved to be an area where good candidates were able to excel. It was encouraging to see a large number of clear answers that gave relevant examples from the text, suggesting that the expected study had been undertaken. A number of candidates limited themselves to a single treatment, and suffered as a result, although where this was deep brain stimulation they still scored several marks. Some misunderstanding was evident in responses describing the use of ECT. Mention of ethical issues led to expressions of opinions about the use of animals in a number of cases, which was not given credit.

Question 7(e)

Rather a large number of responses missed the link between the expression of ChR2 and the presence of light sensitive pigment. Marks were usually awarded for descriptions nervous communication, but references to messages or an impulse were penalised here as before, and mention of rhodopsin.

Question 7(f)

Once again, careful reading of the question would have been helpful to candidates. There were many descriptions of how to get a gene into a virus, including references to plasmids, which were not relevant. The key word was intended to be ‘specific’ which good candidates might have met in the context of HIV and T helper cells.

Question 7(g)

There were a large number of marking points available to candidates who were aware that bradykinin is involved in inflammation, although a significant number did not extend their answer beyond simply stating that it is an inflammatory inhibitor. The significant number of blank spaces for this question suggests that more work could be done in identifying unfamiliar terms in advance of the examination.

Question 7(h)

Knowledge of protocols for testing of drugs is a direct requirement of the specification so it was disappointing that few candidates saw the need to discuss them. Many candidates focused on 'factors', giving a substantial list, rather than 'design' and may have scored two marks if one of them was related to gender. In was not uncommon for candidates to be carried away by the need to control all variables and suggest that the sample should all be of similar age and gender. Better candidates reached full marks by including double blind testing and placebos.

(h) Suggest the factors that need to be accounted for in the design of drug trials of painkillers.

(4)

Many factors need to be accounted for because pain is a "multidimensial" feeling and in order to relieve it, the majority of these factors must be dealt with. The effect of drugs on people of differing ages, gender, ~~and~~ size and genetic background all need to be tested. Drugs need to be trialled on animals ~~kittens~~ to be proven safe and to show up any side effects. Then before the drug becomes widely available, it must tested on a sample of human ~~volunteers~~ volunteers, for example through double blinded random tests.

(Total for Question 7 = 30 marks)

TOTAL FOR PAPER = 90 MARKS

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Examiner Comments

This is an example of an answer where the candidate is using knowledge of drug testing to address the question, and also using the context of the article in illustration. As a result it scores well.

Grade Boundaries

Grade	Max. Mark	A*	A	B	C	D	E	N
Raw boundary mark	90	56	51	46	41	36	32	28
Uniform boundary mark	120	108	96	84	72	60	48	36

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