

Examiners' Report
January 2013

GCE Biology 6BI05 01

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Introduction

This paper offered a wide range of question styles and opportunities for candidates to showcase their knowledge and understanding. It was encouraging to see a number of excellent responses. It continues to be pleasing to see candidate answers to questions relating to the pre-release article as these suggest good engagement and careful preparation. Credit should go to both candidates and their teachers for this.

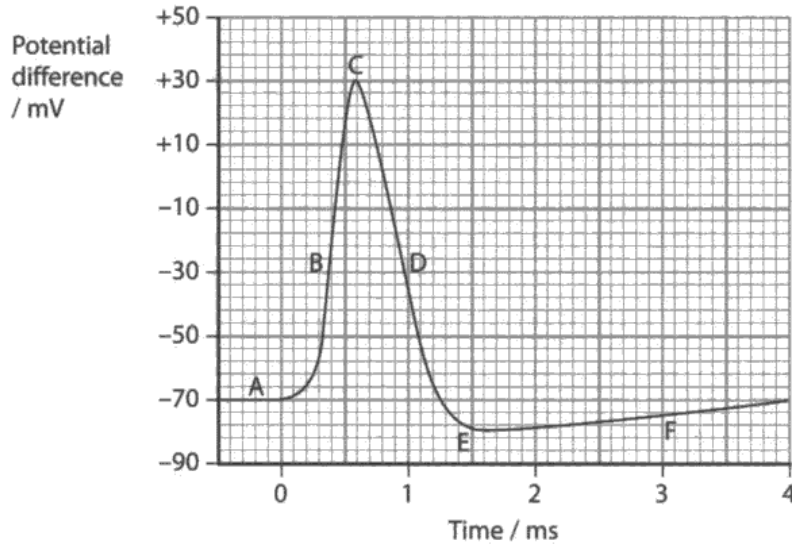
The fully synoptic element of this paper, however, continues to be a demanding aspect for a number of candidates but, ambiguity in candidate responses continues to be less evident.

Question 1 (a) (i)

A wide range of values were offered for the change in potential difference during depolarisation.

This example offers perhaps the most common incorrect response.

- 1 (a) The graph below shows the changes in potential difference across the membrane of a neurone after stimulation.



- (i) Using the information in the graph, state the maximum change in potential difference across the membrane of this neurone during depolarisation.

(1)

109

mV



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Examiner Comments

The candidate has given the maximum potential difference but not in relation to depolarisation. Therefore, no mark awarded.



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Examiner Tip

Make sure the differences between depolarisation, repolarisation and hyperpolarisation are fully appreciated.

Question 1 (b)

This QWC question item allowed candidates to consider the sequence of events that occurred subsequent to neurotransmitter being released into the synapse.


A number of candidates gave detailed and clear answers that considered the movement across the synaptic gap, binding to receptors on the post-synaptic membrane and the subsequent events. Some showed confusion between depolarisation and action potential.

This is a clear answer that is delivered in a logical manner. It covers a number of marking points.

*(b) When a nerve impulse reaches a synapse, calcium ions enter the neurone through the pre-synaptic membrane. This causes a neurotransmitter, such as acetylcholine, to be released.

Describe and explain the sequence of events that occurs at the synapse, after a neurotransmitter has been released.

(5)

After the neurotransmitters are released by exocytosis they are released into the synaptic cleft. The neurotransmitters diffuse across the synaptic cleft to the  bind to a specific receptor on the membrane. postsynaptic neurone. This causes voltage gated sodium ion channels to open in postsynaptic neurone. So sodium ions diffuse into the postsynaptic neurone. Once a threshold has been reached an action potential is triggered. The neurotransmitter are then removed so the response doesn't keep happening and is returned to the presynaptic neurone, ^{by active} transport.



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Examiner Comments

This answer, like many, started by setting the scene. It then delivers marking points 1, 2 and 3. Whilst there is no mention of depolarisation, the reference to action potential is marking point 5. Subsequently marking point 10 is given.



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Examiner Tip

Answering the question in the sequence that the events occur increases the chance of not missing out a salient point.

Question 2 (a) (1)

Most candidates appreciated that molecule R was ATP and, hence, gained the mark.

Question 2 (a) (2)

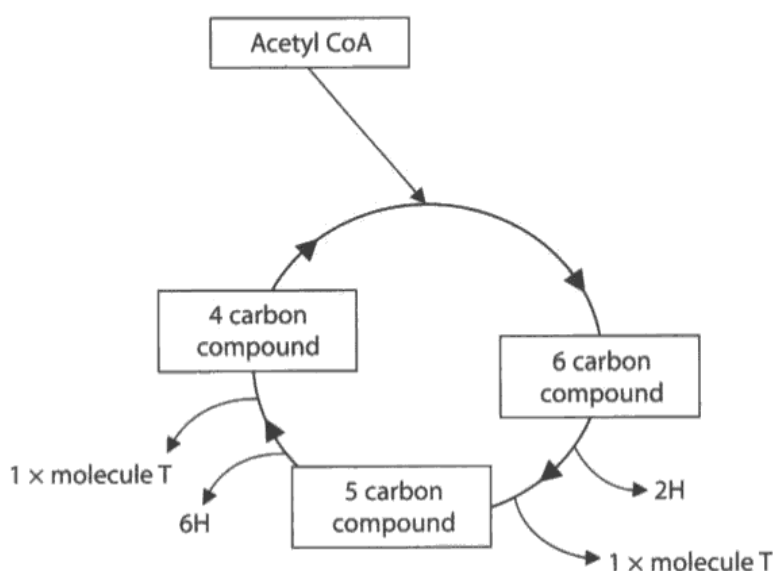
Whilst the majority of candidates recognised that molecule S was ADP, a proportion felt the need to state that it was both ADP and inorganic phosphate.

Question 2 (b) (i)

This question required candidates to identify molecule T as carbon dioxide and to then use the diagram to offer a reason for their choice. Most were able to recognise molecule T.

This answer displays the most common correct explanation for stating that molecule T is carbon dioxide.

(b) The diagram below shows some of the stages in the Krebs cycle.



(i) Name molecule T and use the information in the Krebs cycle diagram to give a reason for your answer.

(2)

Molecule T is CO_2 . We know this as the 6 carbon compound must lose a carbon to become a 5 carbon compound as seen in the diagram.



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Examiner Comments

Both marks were achieved in this response.

Question 2 (b) (ii)

This question required candidates to use the diagram to consider the effect on the Krebs' cycle if acetyl coA became unavailable. Most candidates gained 1 or 2 marks.

This candidates' response offers, perhaps the most common correct answer.

(ii) Using information in the diagram, suggest what would happen in the Krebs cycle if acetyl CoA became unavailable.

(3)

The krebs cycle would not be able to occur without Acetyl coA. If no Acetyl coA is produced then anaerobic respiration takes place where pyruvate is converted to lactate instead of entering krebs cycle. krebs cycle is an aerobic function which requires oxygen + acetyl coA to function.



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Examiner Comments

Only marking point 1 is awarded here.



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Examiner Tip

Make sure that the answer deals with the question.
The second sentence refers to a process not occurring in the Krebs' cycle.

Question 2 (c)

A number of candidates found explaining oxidative phosphorylation a challenging item. Whilst some splendid responses were given, it was not uncommon for candidates to state that hydrogen or reduced NAD is passed along the electron transport chain.

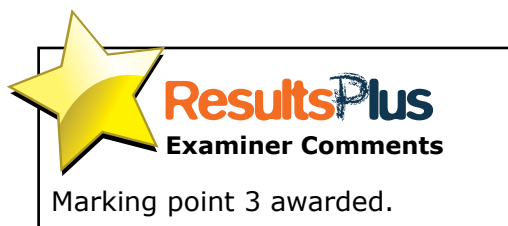
This answer achieved 1 mark. There is no clear direction of H⁺ movement offered in the first sentence, so marking point 5 cannot be awarded. However, the second sentence correctly refers to ADP and phosphate binding together to form ATP. The subsequent two sentences did not elicit any further marks.

(c) The hydrogen (H) from the Krebs cycle enters the electron transport chain and oxidative phosphorylation occurs.

Explain what is meant by the term **oxidative phosphorylation**.

(3)

Protons diffuse and are actively transported through the mitochondrial membrane which creates an electrochemical gradient. This triggers the reaction of joining a third phosphate to ADP to produce ATP. When this bond is broken, lots of energy is released. 32 ATP is produced per glucose molecule in oxidative phosphorylation.



Question 3 (a)

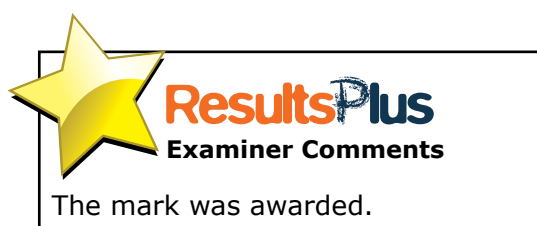
Most candidates appreciated that darkness would help convert active phytochrome into the inactive form.

This example illustrates a typical correct answer.

State **one** way in which the active form of phytochrome can be converted back to the inactive form, other than by exposing it to far red light.

(1)

P_{fr} is converted into P_r when it is dark.



Question 3 (b) (i)

It was pleasing to see a number of good answers that focused on the mean dry mass comparison. However, a number of responses also, unnecessarily, considered mean stem length.

A detailed answer that achieved full marks.

- (i) Using the mean dry mass of the flowers shown in the table, compare the results of group A with group B for both the original and repeat studies.

(3)

The mean dry mass of flowers in group A ~~was~~ is more than the mean dry mass of flowers in group B, in the both the original and repeat studies. However in the original study mean dry mass differed by 13g between group A and B. In the repeat study, the mean dry mass differed by 5g between group A and B. The repeat study showed less difference in mean dry mass ~~of B~~ compared to the difference in mean dry mass between group A and B ~~(than the difference)~~ in the original study. Overall, group A has ~~4~~ flowers with higher mean dry mass than group B.



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Examiner Comments

The first sentence clearly achieves marking point 1. The second sentence correctly comparatively manipulates the data (marking point 2). The third sentence covers marking point 3.



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Examiner Tip

Look to manipulate data rather than just repeat it.

Question 3 (b) (ii)

This question enabled candidates to consider the importance of the far red light/red light ratio on stem length. Delivering marking point 1 only was, perhaps, the most common response.

This is a sound answer gaining two marks.

(ii) The light conditions experienced by group B were similar to those found near ground level in woodland.

Using the mean stem lengths shown in the table, suggest the importance of these light conditions for a young seedling in the woodland.

(3)

- young seedlings near ground level in woodland ~~experiences~~ to experience lower light condition
- lower intensity of sunlight, which is mainly red light
- mean stem length of group B higher than group A
- to allow group B to receive more light in order to grow



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Examiner Comments

The final two sentences achieve the marks.

Question 3 (b) (iii)

This question was admirably tackled by a number of candidates. However, others focused solely on making a conclusion or ignored the given statistics.

This is a fairly typical answer that gains two marks but does not achieve marking point 3 as it essentially repeats part of the question.

(iii) A statistical analysis of the data for mean stem length was carried out.

The analysis showed that there was a significant difference between the mean stem length data for groups A and B.

However, there was no significant difference between the data from the original study and the repeat study.

Suggest a conclusion for the effect of light on mean stem length and use the results of this statistical analysis to comment on the reliability of the data.

(3)

Light has
~~There is~~ a significant effect on the mean stem length of these plants, as you lower the intensity of red light, the mean stem length increases. The statistical analysis shows that there's no significant difference between the data from the original and repeat study, ∴ the data is very reliable.



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Examiner Comments

Marking point 1 is gained in the first sentence and marking point 4 towards the end of second sentence.

Question 4 (a)

It was pleasing to see candidates offering clear and detailed answers to this question.

Whilst the question referred to 'changes in the heart', many felt it was necessary to describe the control of the heart by the brain.

In this example, the first sentence sets the scene and then the next describes aspects of the control. Towards the end of the response, the candidate gains the increase in heart rate and stroke volume mark.

4 Physiological changes occur when a person carries out a period of exercise, such as running 800 metres.

(a) One physiological change will be an increase in cardiac output.

Describe the changes in the heart that bring about an increase in cardiac output.

(4)

The two factors that affect the cardiac output is the stroke volume and the heart rate. To achieve an increase in the cardiac output, the cardiovascular ~~cont~~ centre in the medulla needs to send signal to the SAN in the heart (sinoatrial node) so that the systole of the atria and ventricles happen more often. This increases the heart rate as the heart beats faster each time. Thus, more volume of oxidised blood ^{will} leave the left ventricle. This brings about in the increase of the heart rate and the stroke volume. Hence, the cardiac output increases.



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Examiner Comments

Marking points 1 and 2 were the most regularly awarded marks but, as in this case, all marking points were observed.



ResultsPlus
Examiner Tip

Make sure the answer focuses fully on the question being considered.

Question 4 (b) (ii)

In the past, questions relating to spirometer traces have proved problematic for some candidates and this question was no different.

This response is typical of many. It considers breathing rate and tidal volume rather than what the trace would look like.

(ii) Describe how a spirometer trace recorded immediately after a short period of exercise would differ from this trace.

(2)

The person would complete many more breaths a minute. The tidal volume would remain nearly the same as the lungs don't take in more air with each breath when exercising, only the number of breaths increases.



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Examiner Comments

No marks awarded.



ResultsPlus
Examiner Tip

Always consider the question carefully.

Question 4 (c)

The majority of candidates gained both marks in this How Science Works question item.

The answer given here did not offer any credit worthy variables.

(c) A student used a spirometer to compare the resting breathing rate of musicians who play trumpets with musicians who play violins.

Suggest **two** variables the student should have considered when selecting the musicians, to make the study valid.

(2)

- Both should play an instrument involving breath/blowing.
- ~~Other moment~~ Temperature of surroundings



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Examiner Comments

Neither of the variables offered matched the premise of the question. For example, the second variable considered an environmental one when the question asked about the selection of the musicians.

Question 5 (a)

This item required candidates to select the correct function relating to two brain regions. Most were able to cite two correct responses through a number got them the wrong way round.

This was a nice answer that clearly gave the brain region functions.

Complete the table by describing **one** role of each region of the brain, while she is on the beam.

(2)

Region of the brain	One role while she is on the beam
Cerebellum	To maintain and coordinate balance. Coordinate movement when on the beam.
Medulla oblongata	To adjust heart rate and breathing rate & level of activity and exercise being done.



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Examiner Comments

Both marks awarded.

Question 5 (b)

This question dealt with blood flow within the skin and how its redistribution could aid the gymnast to release the heat generated whilst on the beam.

A number of candidates felt the need to discuss the control of temperature regulation as well as a variety of mechanisms to reduce body temperature even though the thrust of the question was on blood flow within the skin. The example illustrates this.

(b) This gymnast will generate a lot of heat while she is on the beam.

Describe and explain how changes in blood flow in the skin will help her to control her body temperature.

(4)

As internal body temperature rises due to heat; thermoreceptors in blood will detect the change and send impulses to hypothalamus. Homeostasis will take place to keep internal body temperature at a constant equilibrium. Body will respond by a negative feedback system. Motor neurones will produce a response, ^{by effectors} such as; more sweating as this has cooling effect, vasodilation → more blood flow through arteries, hair lie flat, erector pili relax so heat can pass out.



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Examiner Comments

Towards the end of the answer, there is a correct reference to vasodilation. 1 mark.



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Examiner Tip

Many incorrectly referred to capillaries dilating.

Question 5 (c) (i)

Almost all candidates successfully described a ligament but less stated that this ligament was associated with the knee.

A short and clear answer.

(c) Gymnasts can damage their cruciate ligaments.

This is an injury that can be repaired using keyhole surgery.

temperature.

(i) Explain what is meant by the term **cruciate ligament**.

(2)

Ligament holds bones to bones. Cruciate
ligament holds the bones in knee joint.



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Examiner Comments

Both marks awarded.

Question 5 (c) (ii)

This item considered keyhole surgery as a treatment for the gymnast's damaged cruciate ligament. A pleasing number gave good answers worth both marks but some failed to offer an explanation as requested.

This is a good answer that gains both marks.

(ii) A gymnast was offered keyhole surgery to repair her damaged cruciate ligament.

Suggest and explain **two** reasons why she might choose this type of surgery.

(2)

There is less blood loss due to a smaller incision being made than open surgery. There is a quicker recovery period for keyhole as this is a less invasive procedure than open surgery, smaller incisions/smaller instruments, therefore the gymnast can get back to gymnastics quickly.

(Total for Question 5 = 10 marks)



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Examiner Comments

The reference to keyhole surgery being less invasive would have been a suitable alternative to a smaller incision.

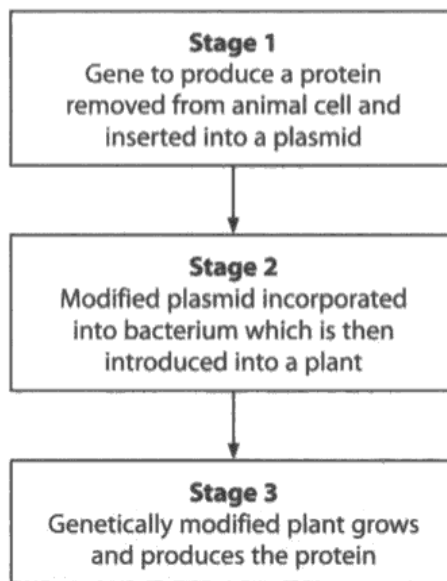
Question 6 (a)

This proved to be a challenging question which focused on the role of enzymes in the removal of an animal gene and its' insertion into a plasmid. It elicited the full mark range with some candidates displaying excellent knowledge of this topic area. Most showed understanding of restriction enzymes and/or ligases but there was less mention of DNA polymerase. A few wrote about gel electrophoresis.

This is a rather confused answer which gained 1 mark.

- 6 Some organisms have been genetically modified to produce proteins including hormones and vaccines.

The flow diagram below shows part of a process to produce a protein, using genetically modified plants.



- (a) Describe and explain the role of the enzymes involved in stage 1.

(5)

The enzymes used in stage 1 have the role of permeating the cell membrane of the animal cell and plasmid so that the proteins can pass from one into the other. This process is necessary otherwise the proteins would not fit through the cell membrane.

Restriction enzymes cut segments of DNA in specific places.



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Examiner Comments

The final sentence makes reference to restriction enzymes and gains marking point 1. However, the subsequent comment about it cutting segments of DNA in specific places would not be awarded marking point 5.

Question 6 (b)

This proved to be a challenging question for a majority of candidates who tended to only consider the animal gene component.

A short answer that was not mark worthy.

(b) Describe the structure of the modified plasmid used in stage 2.

(2)

A strand of DNA



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Examiner Comments

The reference to a strand does not imply a ring of DNA.

This example illustrates the focus given to the animal gene by a number of candidates.

(b) Describe the structure of the modified plasmid used in stage 2.

(2)

Plasmid containing the gene to produce a protein which has been removed from animal cell
The gene is incorporated into the plasmid due to the sticky ends



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Examiner Comments

No marks can be awarded here.

(b) Describe the structure of the modified plasmid used in stage 2.

(2)

The plasmid is a loop of bacterial DNA but this modified plasmid contains an animal gene alongside the bacterial DNA.



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Examiner Comments

Both marks achieved.

Question 6 (c)

This question allowed candidates to offer a range of reasons why plants, rather than bacteria, were used to produce the protein. It was gratifying to see a number of candidates offering good suggestions and marking points 2, 3, 5 and 7 were regularly seen.

This response achieved both marks.

(c) Suggest why plants rather than bacteria are used to produce the protein in stage 3.

(2)

Because plants will produce a bigger size of the protein. It is harder to filter and extract proteins from bacteria. Genetically modified bacteria need to be destroyed straight after as they are risk to people's health.



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Examiner Comments

The first sentence deals with marking point 3 whilst the second sentence was an acceptable alternative for marking point 5

Question 6 (d)

This question proved to be challenging for a number of candidates but it elicited a range of answers with the two most common correct ones being marking points 1 and 2.

This was a considered answer which gained both marks.

(d) Describe **two** risks associated with the use of genetically modified organisms.

(2)

Cross pollination from genetically modified plants to wild species could cause wild species to have an undesirable characteristic e.g. pesticide resistance in weeds. The genetically modified organism may be able to outcompete other organisms, which could lead to a decrease in number of the organisms affected.



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Examiner Comments

The reference to cross pollination is marking point 1. The answer then gives a consequence of the transfer of the gene for marking point 2.

Question 7 (a)

Generally candidates took this question in their stride and achieved at least one mark.

This is a general answer which reiterated much of the question.

(a) Suggest why 'incredibly efficient cellular mechanisms' can increase the chance of obesity (paragraphs 4 and 5).

(2)

Because people who have an incredibly efficient cellular mechanism and do not engage in regular exercise could be increasing their chance of suffering from obesity, diabetes and cancer.



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Examiner Comments

No marks awarded.



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Examiner Tip

Make sure that the question is not just repeated.

Question 7 (b)

A wide range of answers were offered by candidates but it was common to see references to glucose and glycogen.

A typical answer that gained both marks.

(b) A larger VO_2 max means more oxygen can enter a mitochondrion and therefore more energy can be released from fuel (paragraph 8).

Name **two** substances, other than oxygen, that need to enter the mitochondrion to enable energy to be released from fuel.

(2)

- Pyruvate

- NAD



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Examiner Comments

Command word was to 'name' and this response did just that.

Question 7 (c)

It was pleasing to see a number of candidates displaying a good knowledge of the structure of this polypeptide. However, a number felt inclined to describe its function.

This is a sound answer that gained two out of the three possible marks.

(c) Describe the structure of glycogen (paragraph 11).

(3)

Glycogen is a polysaccharide made of many glucose molecules joined by glycosidic links. The ~~one~~ glycogen molecule itself is branched.



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Examiner Comments

The reference to glucose was insufficient. It should have been prefixed with alpha for marking point 1. However, the reference to glycosidic links and branching enabled it to gain marking points 2 and 4.



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Examiner Tip

Be precise. State alpha glucose, not just glucose.

This response considers both structure and function of glycogen.

(c) Describe the structure of glycogen (paragraph 11).

(3)

Found in muscles
glycogen is made up of glucose, it is easily accessible, it is branched. Easily broken down into subunits but can be used ^{to store energy rapidly} in respiration.



ResultsPlus
Examiner Comments

The reference to glucose was insufficient. It should have been prefixed with alpha for marking point 1. However, the reference to branching enabled it to gain marking point 4.



ResultsPlus
Examiner Tip

Make sure that the answer deals with the question being asked.

Question 7 (d)

Many candidates were able to deal with this item efficiently.

This answer correctly considers marking points 1 and 3.

(d) Using the information in paragraphs 12 to 14, explain how lowered testosterone levels may help a cyclist to race harder on successive days.

(3)

Reduced testosterone causes an increase in the production of catecholamines, which boost fat metabolism, a boost in fat metabolism allow more efficient breakdown of fats allowing more energy to be released during endurance events.



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Examiner Comments

Two marks awarded.

Question 7 (e)

This proved to be quite a challenging question with the most common mark being 1. This was usually gained by offering marking point 1.

This is a typical response.

(e) Explain why Coyle suggests that greater muscle efficiency may be linked to an increase in the percentage of **slow twitch** muscle fibres (paragraph 20).

(2)

Slow twitch fibres have more mitochondria and ~~glucose~~^{do not} ~~trig~~ respire aerobically. They do not ^{fatigue} ~~trig~~ as quickly so the athlete may work for longer periods of time.



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Examiner Comments

Marking point 1 only awarded.

Question 7 (f)

This question required candidates to apply their knowledge of the role of calcium ions on muscle contraction in the context of a leak in a specific class of calcium ion channel.

Candidates could interpret this question in terms of either extra calcium ions entering the sarcoplasm or less, and the mark scheme was designed to deal with both possible scenarios.

Most candidates recognised that the question referred to calcium ion interaction with various proteins. However, some did not relate this to a change in calcium ion concentration.

This is a general answer that does not offer the detail required.

*(f) Suggest how 'the development of a leak in a specific class of calcium channel in muscle cells' can lead to muscle fatigue (paragraph 23).

(4)

The majority of muscles inside the body depends on the release of calcium ~~stores inside~~ from their stores. If there is a leak of ~~a~~ calcium in a specific class of calcium channel, the muscles will not be able to contract properly.



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Examiner Comments

No marks could be awarded.



ResultsPlus
Examiner Tip

Always take note of the mark allocation.

This is a strong answer that achieves full marks.

*f) Suggest how the development of a leak in a specific class of calcium channel in muscle cells' can lead to muscle fatigue (paragraph 23).

(4)

The leak in the calcium channel causes calcium ions to leak out of the muscle cells. Hence, less calcium ions are available to bind on troponin molecules on the actin fibre. Less troponin and tropomyosin are shifted. Less ^{myosin} binding sites on actin fibres are exposed leading to fewer formation of actomyosin bridges. Less actin are pulled in between myosin as few power strokes take place. In conclusion, the decrease in calcium leakage of calcium ions causes the muscles to ~~contract weakly~~ to lose their ability to contract effectively hence causing muscle fatigue.



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Examiner Comments

The first sentence describes the direction of leakage so gains marking point 1. The second sentence then points out that, as a consequence, fewer calcium ions can bind to troponin (marking point 2). Subsequently it refers to the movement of tropomyosin (marking point 3). The fourth sentence states that this leads to a reduced exposure of myosin binding sites (marking point 4) and then finishes with marking point 5. Maximum of 4 marks achieved.

Question 7 (g)

Generally this proved to be a challenging question for a significant minority of candidates who referred to either bases or enzymes rather than nucleic acids.

This item required two appropriate nucleic acids for each of the process to gain the mark.

(g) The ACE gene codes for the synthesis of angiotensin converting enzyme (ACE) (paragraph 25).

Complete the table by naming two nucleic acids involved in each of the processes described.

(2)

Process	Two nucleic acids involved in the process
Transcription of the ACE gene	1 DNA 2 mRNA DNA nucleotides
Synthesis of ACE at a ribosome	1 tRNA 2 mRNA



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Examiner Comments

This answer achieved the mark for the synthesis of angiotensin converting enzyme only. 1 mark awarded.

Question 7 (h)

Some candidates offered clear, precise and detailed answers to this suggest question, however, the full mark range was observed.

There were a number of candidates that did not fully appreciate that the profiling was to identify the variant of the APOE gene.

This is a rather general answer that gains 1 mark.

(h) A variant of the APOE gene could put individuals at increased risk in contact sports. DNA profiling is a technique that can be used in genetic screening.

Suggest how DNA profiling could be carried out to identify this variant of the APOE gene (paragraph 27).

(4)

DNA profiling can be used by using electrophoresis. ~~the~~ DNA fingerprinting can also be used to find the gene. In electrophoresis, a gel is used which is connected to an anode and a cathode and the DNA is split, moving to both ends.



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Examiner Comments

The reference to electrophoresis is credit worthy but the subsequent description would not achieve marking point 5.

Question 7 (j)

This suggest and explain question was tackled well by a number of candidates. It was, however, relatively rare to see marking point 1 offered.

This response delivers marking point 2.

(j) The colder the water Japanese Ama divers swim in, the higher their resting metabolic rate (paragraph 50).

Suggest and explain why this might be an advantage to these divers.

(3)

Increased metabolic rate means a higher production of ATP. This ATP is stored in the body and can then be hydrolysed and used for energy during a dive.



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Examiner Comments

1 mark awarded.

Question 7 (k)

This question required candidates to link each of two greenhouse gases with its source to gain marks.

This is a clear and focused answer.

(k) Pugh noticed the effects of climate change (paragraph 53).

Name **two** greenhouse gases that contribute to climate change.

Give **one** source of each of these gases.

(2)

Carbon dioxide, is produced from burning fossil fuels.
Methane, which is produced as a waste gas product in
cows and expelled into the air.



Question 7 (l)

Most candidates were able to carry out the calculation effectively but a number did not consider 37 degrees C.

Paper Summary

The paper enabled candidates to display their biological knowledge and understanding in both familiar and unfamiliar settings. It allowed them to make connections between different areas of unit 5 as well as across the full specification.

In order to help candidates prepare for future papers they should:

- Make sure that the various command words are fully appreciated
- Make sure that the answer fully considers the question being asked
- Look to manipulate data rather than simply repeat it
- Be familiar with the How Science Works criteria
- Be specific and try not to use the word amount

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