GCE A LEVEL EXAMINERS' REPORTS

BIOLOGY
A LEVEL

AUTUMN 2020

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Unit	Page
Component 1	1
Component 2	5
Component 3	7

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COMPONENT 1: ENERGY FOR LIFE

General Comments

There was a limited entry but all questions were equally accessible to candidates, it was rare to see candidates making no attempt at an answer and there was no evidence that candidates had difficulty in completing the paper in full. There was evidence to suggest that not all candidates appreciated that assessment of Core Concepts, How Science Works and the specified practical work stated in the specification are included in Component 1. I was impressed with the mathematical skills demonstrated by many a testimony to some very good teaching.

Comments on individual questions/sections

Question 1

(a) (i) (ii) Virtually all candidates clearly stated the absorption peaks for chlorophyll a but many did not make any reference to reduced absorption in the green regions of the spectrum or incorrectly stated that there was no absorption at these wavelengths. A pleasing number of candidates realised that having a range of pigments increased the range of wavelengths absorbed.

(b) (i) (ii) Nitrogen/magnesium were correct responses given by the majority. Some candidates got hydrophilic and hydrophobic the wrong way around but most were able to explain the orientation of chlorophyll in the membrane.

(c) There were many excellent responses showing a clear understanding of photolysis. There seemed to be far fewer hydrolysis answers than on previous occasions.

(d) Many excellent answers.

(e) (i) Most candidates correctly calculated surface area and volume. There was some difficulty found in expressing the ratio, some stated that the SA: Vol ratio was 1:10 and many multiplied the calculated values by 10 and gave the ratio as 11:1

(f)
(ii) Many excellent responses.

(g) (i) (ii) It was obvious that the majority of candidates had a knowledge of Gram staining.

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Question 2

(a) (i) It was rare to see correct responses with the majority of candidates considering that the key issue concerned the type of bonding.

(ii) There were some excellent responses but these, I am afraid were in the minority. Large numbers of candidates referred to protein synthesis or the structure of nucleotides.

(iii) Many candidates showed no appreciation of the one gene one polypeptide hypothesis and in consequence the numbers stated were often huge and varied but alas incorrect.

(b) (i) RUBP and CO_2 often given as correct responses.

(ii) GP commonly given as the first phosphorylated sugar and the inorganic ions present in nucleic acids and proteins was not generally known.

Question 3

(a) The majority of candidates were able to give very good examples of anabolic and catabolic reactions.

(b) (i) There were some exceptions but candidates were unable to explain the meaning of the term 'substrate level phosphorylation'.

(ii) There was a very good understanding of chemiosmosis with the majority of candidates obtaining all 3 marks.

(c) Clear understanding of non-competitive inhibition was shown.

(d) (i) The majority of candidates correctly stated why ATP production was reduced.

(ii) Many candidates failed to explain why sweating occurred or why the neck, shoulders and chest became red and just restated the stem of the question.

Question 4

(a) There were some very good responses but marks were lost for not giving explanations. I was surprised that no candidate used the term 'carrying capacity'.

(b) (i) (ii) There were some excellent responses for both sections but a significant number of candidates argued that reducing the numbers of mature fish would result in a quicker recovery because competition for resources would be less.

(c) Some candidates did not appreciate that fish farming involved keeping large numbers of fish in a small area and seemed to think that it would lead to reduced numbers of fish in the environment and therefore reduction in carbon dioxide and nitrate levels. There were a large number of well argued answers and all points on the mark scheme being given.

(d) The majority of candidates clearly understood the difference between primary and secondary succession.

(e) A well answered question probably in tribute to David Attenborough.

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Question 5.

(a) (i) For many candidates serial dilution still causes a problem but there were some correct responses.

(ii) Almost all candidates stated that in plate C there would be an overlapping of colonies but many stated that plate E would not be used because the numbers of colonies could not be accurately counted.

(b) Some candidates correctly stated that the effect of the independent variable was not reliable unless all other variables were controlled. Very few stated that changing the nutrient would affect the growth of the culture or that different incubation periods would result in different colony sizes or a risk of merging.

(c) Candidates often lost marks by imprecise statements such as 'increase the temperature' or 'expose them to heat'.

(d) Incubation at 37^0C was a common answer but very few candidates gave anaerobic as the second condition required to culture bacteria from the human intestine.

Question 6

(a) (i ii iii) Except for (i) very good responses.

(b) The majority of candidates correctly stated that $C0_2$ levels go up and the pressure increases.

(c) Not adding yeast was a common response but not accepted. The control, in this case, is to repeat the experiment using boiled and cooled yeast. Candidates should emphasise that in the control all other conditions are the same. Most candidates were able to correctly state the need for a control.

(d) (i) Most candidates found no difficulty with the calculation.

(ii) A surprising number of candidates failed to put headings in the table, several did not put units and large numbers did not give the transferred standard deviation to the same number of decimal places as the others in the table.

(iii) Some excellent conclusions based on the standard deviation were given.

(e) Most candidates correctly stated that sucrose was a disaccharide and would need to be hydrolysed.

(f) It was quite rare to find a correct answer to this question, very few candidates appreciated that aerobic respiration uses oxygen and releases carbon dioxide and in consequence there would be no change in volume of gas.

Question 7

Very few candidates were able to describe clearly what is meant by energy flow and failed to refer to energy rich organic molecules passing from one trophic level to another when food is consumed. Respiration was the most common cause for loss at each trophic level given although many candidates did not state respiration but referred to heat loss. Many candidates continue to confuse egestion and excretion thinking they are synonymous terms. Candidates were not able to state clearly why the efficiency of transfer between different trophic levels would vary. Most considered that the most

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efficient transfer was between producer and primary consumer. There was very little reference to data. Prevention of animals moving or keeping them warm were commonly given as ways of improving efficiency of energy transfer but it was rare for a reason to be given. Breeding animals with increased efficiency or growing autotrophs with higher efficiency or feeding animals with reduced cellulose or high energy supplements was rarely seen.

Summary of key points

- Candidates should remember that Core Concepts will be included in the assessment and that a knowledge of the specified practical work is required and could well be examined.
- It is expected that candidates are aware of how to present a scientific table of results to include the use of the same number of decimal places in each column, units and correct headings.
- Candidates should understand that there is a difference between the terms reliability and accuracy.
- Many candidates needlessly lost marks on this paper by simply not answering the question, an old fashioned statement but still very relevant.

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COMPONENT 2: CONTINUITY OF LIFE

General Comments

In my opinion, the challenge of the paper was similar to that of other years and all questions were accessible. The main difference this year was the lockdown period due to COVID which could have affected teaching and learning. However, candidates sitting this decided to do so and, therefore, had to be prepared to be tested on all content set out for this component in the specification.

Comments on individual questions/sections

Question 1

Generally well answered with all marking points seen in candidates' answers. Marks were lost, mainly due to students not being able to calculate the simplest ratio of numbers (ie., divide all numbers by the smallest number) and not being able to explain genetic crosses rather than completing a diagram to show a genetic cross. Linkage was understood by the majority but many could not explain how recombinants can be formed during meiosis.

Question 2

Some marks were lost on the microscopy questions and I felt that there was confusion between the total magnification of microscope lenses and the power of a particular lens. There was also much confusion over calculating the number of mitotic divisions to reach a certain number of cells. Many just divided the total number by two or took a square root of the total. Explaining semi-conservative replication of DNA was better than on some previous papers but still lack of detail or poorly communicated answers cost marks.
Parts (d) and (e) of this question were less well answered than the rest of the question. As mentioned already, most of the content would have been taught in April / May ie., during lockdown. However, some candidates gave excellent answers to all parts of the question. The main problem was, despite candidates being told about methylation of gene promoter regions, most decided to explain the effect of acetylation of histone proteins as an epigenetic effect.

Question 3

Few candidates could calculate the number of chromosomes in different plant cells. It was unclear whether this was due to not remembering which cells are haploid, diploid or triploid or not understanding the term 2n as being the diploid number. Part (b) of this question was based on the extraction of DNA – a practical in the Laboratory Manual. It has been stated in previous examiners' reports that **all** practicals need to be covered and can be assessed in theory papers, not just the practicals that a centre uses to cover their practical assessment requirements. Parts (c), (d) and (e) again tested content usually taught towards the end of year 13.

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Question 4

The only part of this question that was poorly answered was (c). Most candidates knew what is meant by an intron but few could explain how splicing can result in a single gene producing more than one polypeptide or knew the details of genetic modification using synthetic DNA sequences. Some of the content tested in this question tested core content and, possibly, had not been revisited since Year 12.

Question 5

Overall, this was the best answered question on the paper and most candidates were able to answer the questions correctly. Candidates lost marks by not referring to and using information in diagrams, not being precise in their descriptions (even when instructed to be) and in not using information as stated when identifying control variables etc. Conversions of units (in this case from mg to g) remains a problem and again they must read the instructions when calculating their answers.

Question 6

Part (a) of this question tested content from Components 1 and 3 and showed that many candidates could not recall information from other units or did not read the instruction to be precise in their answers. Part (b) of the question tested a range of mathematical and practical skills associated with DNA analysis. Use of logarithms is a required maths skill and candidates' ability to use $\log_{10}$ was variable. What was surprising was the number of candidates who did not plot a simple, straight-line graph correctly – values correctly calculated on the previous page were not plotted, a line of best fit was hand-drawn and axes left unlabelled. The use of a DNA ladder has been tested in previous papers in various ways and remains a problem.

Question 7

The QER was well answered. The main problem seemed to be confusion of allopatric and sympatric speciation and confusing the details of the two with natural selection. The question asked candidates to use the information provided. Many gave extensive, theoretical accounts of the subjects covered by the question but could not gain maximum marks as they did not apply their knowledge to the examples given.

Summary of key points

- Candidates need to read the instructions when answering maths questions.
- If a question asks them to use the information or to refer to a diagram this needs to be followed to gain all marks available.
- This qualification tests content for the components and the core content – revision of Year 12 and 13 work is essential.
- ALL practicals can provide the basis for a theoretical question. Centres need to ensure that students are aware of all the practicals in the laboratory manual together with slides and other practical work included in the teachers' guide.

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COMPONENT 3: REQUIREMENTS FOR LIFE

General Comments

There was a range of standards seen in many of the answers but all of the marking points were seen during the marking process. The standard of the mathematical responses was very good. Questions that required the application of practical skills in novel contexts proved less challenging than in previous years.

Comments on individual questions/sections

Question 1

It was pleasing to see that most candidates are writing that a curve to the left indicates that this haemoglobin has a higher affinity for oxygen. Unfortunately, some candidates lost marks referring to the penguin having a higher affinity for oxygen. Many did not recognise that this type of haemoglobin acts an oxygen store and releases the oxygen when the partial pressure of oxygen is quite low. Some referred to the haemoglobin being fully saturated at low partial pressure of oxygen so the penguin could live at high altitudes or low oxygen concentration environments.
Part b was the best answered question on the paper. Most candidates could define a tissue and describe differences seen in the photographs.
For part ci some candidates explained why the air should be warmed rather than how the air is warmed. Very few could explain how the penguin's gas exchange system was efficient. The valves keep a one-way flow of air over the lungs. The gas exchange takes place when inhaling and exhaling as air is constantly being moved over the lungs. The air sacs do not give a larger surface area.
Most candidates described the air and blood flow being in opposite directions and wrote about a concentration gradient over the whole length of the parabronchus (not gill) Many then wrote about diffusion of oxygen into the blood across the whole length.

Question 2

Most spotted that there were more sodium ions outside the axon compared to inside and then gave a reasonable explanation as to why. Some candidates lost marks for stating that sodium ions were being actively transported or pumped out of the membrane and not out of the axon. Candidates who wrote about the hydrophobic tails/fatty acids preventing the sodium ions moving across the membrane gained credit for part ii, as did those who said the sodium ions are not lipid soluble.
Part b asked about potassium ions. There was no credit for describing what happens to sodium ions. Some candidates where confused as to where the potassium ions were moving (if the channels are blocked, they stay inside the axon).

Question 3

Part a was recall. Candidates needed to know that saturated fatty acids have a more negative impact on health and they then needed to identify B as a saturated fatty acid.
Part bi was answered well; just extracellular was required. Bii was a little disappointing and it made this one of the least well answered questions. Many candidates had the idea that fats

may have different fatty acids but few then linked this to enzymes having to have different shaped active sites to accommodate these different shapes.
The calculation in ci was carried out well, although some candidates dropped a mark for not using standard form as required by the question. Some candidates did not use the tangent and worked out a rate using 30 seconds and 1.26g, which gained no marks.
Many candidates described the shape of the curve well; steeper was allowed. Many also wrote about emulsification and the increase in surface area.
For part iii, many candidates wrote about high protein diets even though the gall bladder stores bile used in lipid digestion.
For part e, equilibration of the temperature inside the test tubes was allowed, but most described the temperature reaching 30ºC. 5 minutes to reach this temperature is considered ample so not enough time to equilibrate was not given credit as an inaccuracy. Difficulty deciding the end-point was the most common answer. Combining the contents of the tubes outside the bath causing a drop in temperature was also credited. Different descriptions of the solutions not mixing fully were allowed and so agitating/stirring the contents was a good improvement. Using a buffer would not work; the colour change relies on a pH change.

Question 4

Many candidates mixed up the medulla and cortex for 4ai. There are no glomeruli or Bowman's capsules in the photo.
Many candidates gave a symptom and could partly explain the reason. There were many different ways in which the water potential gradient being lowered was described.
For part b, many candidates gave good evidence and explanation. Saying 3 and 4 were carriers was allowed. 1 and 2 giving rise to 3 cannot be used as it could show that it is dominant (1 could be nn and 2 Nn, giving rise to 3,nn.). A significant number of candidates believed that 3 and 4 were the offspring of 1 and 2.
4c needed X and that that had the longest or longer (not just long) loop of Henle.

Question 5

Part a was the least well answered question on the paper, which is surprising as part ii is recall. The ethical killing of aphids was well described in ai. Carbon dioxide is used, but candidates were not expected to know that. "Gas" was allowed, but anaesthetic was the most common answer. Part aii depended on the candidate knowing that sucrose is a non-reducing sugar and then recalling the test for a non-reducing sugar. The sample is tested for a reducing sugar first; this must stay blue/be negative. Then all of adding acid, heating, adding alkali then Benedict's again and heating must be present for the second mark.
The rate of movement was well done for bi and errors at both ends or just one end of the bubble were allowed for bii.
Candidates lost marks for imprecise language in ci. "Strongest sun", "stronger light" are not considered good enough to mean highest light intensity, although candidates could still gain the second mark for highest rate of photosynthesis around midday. For ii, many candidates wrote about the sugar being used by the fruit to attract insects. This is not a question about pollination, but many candidates thought it was.
Part d was referring to features in the image and so sieve end plates and plasmodesmata were ignored in answers.

Question 6

Part (a) needed the sino-atrial node and the location (A) for one mark. It was pleasing to see that the majority of candidates could calculate the heart rate by dividing 60 by 0.9.
Most candidates gained at least 2 marks for commenting on the validity in 6bii, with the age range and the gender imbalance being the most common. Many also commented on the

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sample size being too small and several candidates also pointed out that the patients' medication may have varied. All of the marking points were seen in the answers.

Question 7

The performance on the QER question varied widely, although there were far fewer lower band answers than normal. There were some excellent answers which gave reasons for the relationships between surface area and mass and behaviour/habitat. Some answers just listed factors without explanation eg as mass increases candidates needed more than just "gives a larger surface area". They needed to state what for. As usual, respiration "Making" energy will not be credited. Some candidates did not make the link between oxygen diffusing into the blood and then the oxygen being used for aerobic respiration. Some of the better candidates did write about slow moving water not maintaining the concentration gradient. The image was there for candidates to make conclusions for the effect of pollution. Some candidates didn't use the image and wrote about eutrophication or increase in water temperature. It is doubtful that the lighter areas on the photograph are "air spaces in the gills". Decreased surface area and increased diffusion distance were the better descriptions that were explained.

Question 8

Most candidates had an understanding of the word endemic in part (a) and produced acceptable descriptions. The few answers that made simple references to a recurring disease were not sufficient.

In (b)(i), the majority of candidates were able to use the information in the life cycle diagram to provide logical suggestions. Of those who did, preventing multiplication before the liver or red blood cells were damaged was the more common response. The idea that sexual stages of the life cycle would not be reached was less common but deserved credit. Very few realised that the parasite needs to be outside human cells. Those candidates who answered (b)(ii) correctly understood the concept of antigenic variation. Statements about mutation with no reference to changing antigens were not given credit. Fewer candidates showed a clear understanding of a biological control in the context in (b)(iii). Of those who answered correctly, some suggested using a placebo. The concept of substituting the vaccine for an inert equivalent was unfamiliar to many and descriptions of constant variables were the most common incorrect answer. The majority of candidates were able to explain the concept immunity from maternal antibodies in (iv) although a significant number omitted to describe this as passive immunity. Some suggested incorrectly, that this was the answer to part I however a significant number of candidates answered part I correctly and realised that infants' immune systems are less well developed.

It was encouraging to read the better answers in (c)(i) refer correctly to plasma cells producing antibodies specific to the antigen described in this question. Some candidates gave answers containing irrelevant detail and others used incorrect references to plasma proteins. Many candidates in (c)(ii) suggested that an immune response would be too slow but most omitted to state the consequence could be fatal or potentially harmful. Those who answered (iii) correctly showed that they were able to use and interpret the information given to them. The majority of candidates answered this question in the context of antibody thermostability and many achieved both marks although some didn't recognise the significance in terms of reduced refrigeration. Answers suggesting the anti-venom would withstand higher body temperatures due to fever were rejected. A small number of candidates gave the alternative correct response relating to body size of camels v sheep.

Many candidates showed a good understanding of bacterial cell wall structure in (d)(i) with accurate answers. To obtain the second marking point relating to water uptake, the direction

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of water flow needed to be clear. Far fewer candidates were able to obtain this mark as a result. References to exploding cells should have been avoided. Knowledge of bacterial cell wall structure was also evident in (ii). Candidates were able to describe the difference between gram –ve and gram +ve bacterial cell walls and most could relate its structure to providing protection from penicillin.

On balance, (e)(i) was answered well. Few candidates were unable to read the correct $\log^{10}$ from the graph and most found the correct antilog. However, some neglected to round up to a whole number which is a logical step to find the number of bacteria (whole organisms). Candidates used several correct examples of compounds for which a source of nitrogen would be required in (ii). A small minority were unable to do so.

QUESTION 9

Candidates had little trouble identifying a thoracic vertebra in (a)(i), but were less able to recognise rib articulation points. Candidates should be familiar with the distinctive structure shown in the photograph in (ii). Not all were able to identify it correctly. Answers to (iii) showed that candidates were able to recall the names of inorganic compounds more readily than organic compounds. Several suggestions were not compounds. Credit could not be given for names of ions or elements.

The calculation in (b)(i) posed few problems. The majority of candidates were able to appreciate that the samples with the lowest standard deviation in (ii) provided highest level of confidence in the data. In (iii), more able candidates realised that weight bearing bones were chosen because they were more likely to be affected by weightlessness. Few realised that non weight bearing bones were selected as a comparison because they might be less affected by the same conditions. Some candidates in their answers to (iv) were able to describe the function of osteoblasts in increasing bone matrix but the concept of bone resorption or breakdown was missed by many. Few appreciated that bone density loss or gain depends on the balance of both. Links between the mechanical stress caused by running and its effect on the weight-bearing bones needed to be clear.

In (c)(i), cartilage was identified correctly by most candidates. No marks were awarded for suggesting structures that were not tissues. Good answers to (ii) required some reference to proteins or antigens causing an immune response. Stating that the immune system recognised tissue as foreign, lacked the necessary detail to gain credit. Candidates were familiar with the diagram of an actin filament in (iv). Most showed they were able to interpret the same structures in section and identify structure Y. On the whole, there were some good answers that explained the process illustrated in the diagrams using the appropriate terms correctly.

QUESTION 10

In (a)(i) which tested basic recall, most candidates produced acceptable descriptions of innate behaviour. Responses that used the term inborn with no further explanation were not given credit. (ii) tested application of practical knowledge. Within the context of this investigation, too many candidates were unable to appreciate that temperature would affect the rate of metabolic reactions and therefore the rate of movement in the animals used.

An encouraging number of candidates identified a kinesis correctly in (iii). Explanations for the pattern of movement were varied and not always precise. Suggestions that implied individuals were heading to or from an area, i.e. directional movement, negated a mark. Candidates needed to use the information given in the stem of question (iv) to reach a conclusion. Some commented, correctly, that inside a dead animal would be wet or humid.

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Few stated that the maggots' behaviour was more likely to keep them there. Several answers suggested maggots could 'find' a dead animal despite being told that they hatched from eggs that were laid there. References to factors other than humidity, which was tested in the experiment, were not relevant. The best answers showed an understanding that the position of the individual depended on probability and not directional movement. In part (v), a relatively small number of candidates suggested the pathway of the maggots may have deviated from the straight lines drawn. Incorrect answers included descriptions of changes in the speed of movement.

In (b)(i), it was encouraging that most candidates were able to recognise the phenomenon known as neuroplasticity from the photograph. For (b)(ii), candidates were more likely to access the first two marking points correctly. Good answers referred to synapse formation (as stated in the graph), avoiding less precise references to 'nervous pathways'. Better responses also included references to the sequence of synapse formation for hearing and for speech. The distinction between sensory input and motor function was not always clear. The majority of answers could have benefitted from using data from the graph to qualify statements. Some candidates in part (iii) referred to synaptic pruning or gave an adequate description of it but in order to gain credit, needed a link to the time when hearing was restored.

It was pleasing that a large proportion of candidates were able to state the difference between methods of image production used in CT and MRI in (c)(i). Marks were awarded only if a comparison of both types of scan was clear. Several candidates managed to state only one valid advantage for using MRI. Part (ii) was a practical question and only a small proportion of candidates were able to suggest an appropriate confounding variable in order to produce a valid comparison. The calculation in (iii) was completed correctly by the majority of candidates but fewer candidates were able to evaluate the difference between two ratios. An awareness of the proportional difference in loss of volume was appreciated in the better answers.

Summary of key points

If a specific figure or table is referenced in a question, the marks will be directly related to it. Don't waste time rewriting the question before answering. If the question needsa phrase or one word answer you do not need to write "the answer is …."
Show your working out for maths questions; even if the answer is incorrect, you may gain credit for how you worked out the answer.
If a question asks about specific ions (for example 2ai sodium ions) don't expect credit for writing about other ions (in this case potassium ions). Answer the question that is set.
Questions requiring core biology knowledge were generally badly done. Core biology will be examined.

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