GCE A LEVEL EXAMINERS' REPORTS

BIOLOGY
A LEVEL

AUTUMN 2021

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COMPONENT 1 – ENERGY FOR LIFE

General Comments

There were some very good responses indicating a depth of understanding and, in general, the answers to the questions involving mathematics were much improved from last year. Understandably, questions demanding knowledge and understanding of the practical aspects of the specification caused problems for some candidates. There was no indication that candidates found difficulty with time and most attempted all sections of each question.

Comments on individual questions/sections

Q.1 Most candidates cited the thylakoid membranes as the precise location of photosystems in plants but very few appreciated that Chlorophyll a is at the reaction centre or mentioned PS1 and PSII.

The principles of chromatography were well understood, and calculation of the Rf value correct. The method used to apply the pigment rather than how to concentrate it was commonly given and many candidates were unable to state a variable which would need to be controlled if this method was used to compare pigments in leaves of two different species.

Q.2. Most candidates correctly identified the shapes of the three bacteria and the reason for the difference in staining with Gram stain correctly stated.

The majority of candidates were able to explain why micro-organisms must be provided with a source of nitrogen and phosphorus.

There were many very good responses to the question involving the identification of the bacteria incubated using the MacConkey's mannitol salt agar.

Q.3 Candidates were able to give a reason for the cold water between the light source and chamber and for the use of the same ten plants. Very few stated a control for the experiment but confused control with controlled variable. The modification of the apparatus to determine the mass of carbon dioxide released by respiration was poor.

Only rarely was the data shown in the table relating to the temperature at which tomato plants are grown used to explain the effect on the sugar content of the tomato. The term epigenetics was correctly stated by some but very few candidates were able to explain how methylation could affect protein synthesis.

Q.4 Many candidates were able to clearly explain the meaning of fixed used in the context of nitrogen fixation and had a very good understanding of nitrification, ATP synthesis and the Calvin cycle.

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Q. 5 Responses to the % change of breeding pairs of redshank were excellent. Most candidates correctly stated that all species declined in the presence of hedgehogs but very few stated that dunlin and snipe also declined in the absence of hedgehogs and therefore hedgehogs were not the only cause of the decline in waders.

Correct reasons for the increase in the hedgehog population and the ecological problems associated with the control measures were given by almost all candidates.

Q.6 There were some excellent responses to explain how cyanide would prevent the process of aerobic respiration. The calculation of the number of apple seeds which would kill an adult pig were usually correct but, I must admit, there were some bizarre answers indicating that the candidate had not questioned their calculation. Knowledge of anaerobic respiration was poor.

Q.7 The terms climax community and secondary succession were defined accurately. Candidates found it very difficult to explain how sea otters maintained biodiversity.

The effect on global warming caused by the destruction of sea otters was clearly stated by most candidates. The homeostatic role of the high density of hair, the calculation of the numbers of hairs per square centimetre and the conservation measures which may have aided recovery of populations were generally good.

Q.8(QER) The quality of written responses were generally poor because they did not explain how the internal structures of mitochondria and chloroplasts were adapted the organelles to function.

Descriptions given for chloroplast were often much clearer than for mitochondria. Candidates often gave long descriptions of the endosymbiont theory but the evidence to support it was spoilt by inaccuracy such as 'mitochondria, chloroplasts and bacteria all have a cell wall'.

Summary of key points

1. Many marks are lost because the question is not answered. It is good practice for a candidate, especially in the longer questions, to revisit the stem and check that they are answering the question and not giving all that they know about the topic.

2. Handwriting continues to be poor and it should be emphasised that answers should be written in the spaces provided or the additional pages at the back of the booklet. If these pages are used it is important that there is some indication that the answer is continued. It is likely that answers in any other blank space will be missed.

3. It should be emphasised to candidates when doing a calculation to look at the answer and just ask themselves does it look correct. In this particular examination stating that 2 apple seeds will kill an adult pig is likely to be wrong.

4. The knowledge of the specified practical work in the specification is expected and will be examined. The weighting for the indirect assessment of practical skills will be a minimum of 15%.

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COMPONENT 2 – CONTINUITY OF LIFE

General Comments

A very small number of candidates sat this paper. Considering the major effects on education since March 2020, the overall standard of answers was good.

While it is not possible to compare performance on this paper to papers sat under pre-COVID conditions or to consider performance trends, the standard of the students' answers was comparable to that seen on previous papers.

However, there were some issues / problems faced by some students. Even though some issues may have been less apparent if students had been taught and prepared for the examination under more normal circumstances, the issues described made below should be addressed by students in future examination sessions.

Comments on individual questions/sections

Q.1:

As in many past papers, candidates insist on comparing DNA base sequences when analysing proteins rather than comparing amino acid sequences of a protein. They also need to read the question as most gave answers about determining the degree of evolutionary relatedness rather than species identification. Overall, a poorly answered question.

Part (b) of this question posed problems in terms of understanding sampling techniques. When calculating a Simpson's index most candidates produced correct answers but several did not follow the formula given and made basic errors.

Q. 2:

Part (a) of this question tested students' knowledge of domains and kingdoms in classification. The answers varied considerably in terms of recall of features of different taxa.

In part (b), when linking the role of ATP in organisms to providing evidence for evolution, students overcomplicated their answers and as a result, lost marks.

Q.3:

Most students could identify the stages of meiosis from the images provided in part (a) but linking these images to spermatogenesis in mammals in part (b) (ii) posed more problems.

The role of <u>random</u> fertilisation in increasing genetic variation was not well understood. Many did not read the rubric of the question and described crossing-over or independent assortment in their answers.

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Part (d) required students to link their knowledge of pollination and synoptic content from Component 1. There was much confusion as to the effect of crossing the climate change boundary (increased atmospheric temperature with no change to day length). In addition, it seemed that some students had not used the information provided on cross-pollination in apples. As a result, while some excellent answers were seen, most did not correctly link climate change to a possible reduction in pollination.

Q.4:

On the whole, this question, including the core content in part (a), was well answered. However, there was some confusion between hydrophilic and hydrophobic and in the use of attracted / repelled.

The main difficulties were seen in the calculation of allele frequencies using the Hardy-Weinberg equations. Most problems were caused by students not recognising that the value of 0.16 given in the stem of the question is q^2 and that q is therefore the square root of this value. There was also confusion between the terms proportion and percentage. If a question asks for a proportion to be calculated then the answer must be given as a value between 0 and 1.0. Similarly, if the answer should be a percentage then a value out of 100 is the required format of the answer.

Q.5:

In parts (a) and (b), despite allele symbols and phenotypes being given, several students changed these and lost marks. In part (b), errors were made in stating the genotypes and gametes and also in identifying the possible genotypes for each phenotype.

Most students calculated the Chi^2 value correctly, but several made simple errors when calculation the expected values or in simple addition of $\Sigma(O-E)^2/E$.

The main problem when answering part (b) of this question was stating a suitable null hypothesis in part (i) and identifying the critical value in part (iii). Some used a probability of 0.50 rather than 0.05 or did not identify the degrees of freedom correctly.

Q.6:

Throughout this question there was evidence of students being unsure of the terms exons and introns which resulted in confused and incorrect answers being given.

Several students did not appreciate that part (b) asked for a simple description of transcription and gave a detailed account of protein synthesis. Many answers made little reference to then information provided to explain why dystrophin in DMD patients is shorter.

Q.7:

Many good answers were seen to all parts of this question. The main problems were confusion of the terms intra- and inter-specific when describing competition and consequently, not recognising that two species do not compete with each other for the same mates.

Part (b) (i) asked students to use their knowledge of natural selection. Most gave generic answers and did not relate the principles of the origin of variation and survival of the fittest to the context of this question. Many students continue to refer to the next generation inheriting the genes that confer an advantage rather than the <u>allele</u>.

Q.8 (QER):

Students were asked to read information about the original human genome project, 100K projects and about sequencing the *Plasmodium* and *Anopheles* genomes. As part of this information, they were also given a map showing the location of ten 100K projects.

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Very few really good responses were seen to the questions asked. Most students appear to have attempted to answer this question from memory rather than using the information provided. Many of the answers lacked the details given to them and many general statements were made that did not relate to the information provided. Little use was made of the map to identify issues with the 100K projects in terms of global application.

The best answers to this QER referred to the information provided and then produced clear, reasoned answers which related directly to the three parts of the question.

Summary of key points

1. Students must read the instruction given in the stems of the questions to avoid making basic errors.

2. They need to use information provided when explaining their answers – they do not always have to rely on memory as Assessment Objective 3 requires them to be able to bring several items of information together to answer questions.

3. All practicals outlined in the lab book can provide the basis for questions even if they have not been carried out by a centre.

4. Handwriting and clarity of expression continue to pose problems.

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COMPONENT 3 – REQUIREMENTS FOR LIFE

General Comments

As usual, there was a range of standards seen in many of the answers but all of the marking points were seen during the marking process.

Comments on individual questions/sections

Q.1 Most candidates gave amylase as the first answer. Carbohydrase was not precise enough to gain credit. Candidates just needed to give letters for the structures but many gave the name as well. Many gave just one structure, or several.

For part (b) several candidates lost marks as they did not work out that two water molecules would be removed during condensation. In part c many candidates gave insoluble as a property. Not many stated that it was a large molecule so would not diffuse out of the cell. Adding a blue dye for part ii was not enough to gain credit. This tested that students knew that iodine solution will turn blue-black in the presence of starch, but many gave Benedict's or biuret. There were also several Gram stains.

In part (iii) many candidates lost marks due to measuring in cm and then converting to µm by multiplying by 1000, instead of using mm. However, they could still gain credit for dividing by 27.
Several answers to part (d) did not give differences between the two types of molecule and so did not gain marks. Some candidates are still under the impression that cellulose contains beta and alpha glucose.

Q.2

Most gained marks for references to the hydrogen bond between the polar molecules and went on to describe cohesion. If the bond between oxygen and hydrogen molecules was mentioned there was no mark awarded. If reference was made to movement by cohesion-tension no credit was given. Adhesion was described well.

All of part (b) was answered well by many candidates. Many gave two conditions for part (iii), but amount of light instead of light intensity is not acceptable. It was good to see the majority of candidates writing 48 in the table after working out the answer as 48.2. Using the same convention as already written is important, although one candidate did work out 48.2 and then rounded that figure up to 49 in the table.

For part (vi) I, many worked out that the potassium ions were not actively transported into the guard cells (not stomata) and the stomata remained closed. Some referred to no water moving in by osmosis and a few referred to water potential, although that was not needed for the mark. Too many candidates wrote about stomatal opening without reference to the question. For part II most worked out that carbon dioxide would not enter the leaf, although a few stated that light enters the leaf through opened stomata.

Q.3

Part (a) was a recall style question. A common error was to think that the ribcage moving upwards and outwards caused the diaphragm to contract.

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Part (b) was answered well with most referring to the fact that it was unlikely to be toxic in such small concentrations. Most candidates referred to a lower surface area in part (c) and then stated that less CO would enter the blood. Some became confused and did not work out that the CO in exhaled air is measured, so the less CO in exhaled air the more has been absorbed by the blood. Just referring to less gas exchange did not show enough understanding for the mark.

Part (d)(i) was answered well although a significant number thought the cells from the mother and foetus were the reason for the difference. For part (ii) many gave the slowing down of the cells (due to friction) giving more time for exchange. Part (ii) was synoptic with Component 2, so candidates who remembered their Component 2 content scored three easy recall marks here.

Part (e) was well answered, with many candidates able to give their answer to the calculation in dm^3.

Q.4

In (a)(i) credit was not given for stating that using log scales making the data easier to plot. Part (ii) is similar to questions asked previously so it was good to see answers where the candidate has used past papers and mark schemes. However, please remind candidates that memorising mark schemes without understanding them will not always give them marks. Increased diameter giving an increased surface area was often the first mark, but increased space for ion exchange was too vague.

Part (b)(i) asked why a higher temperature would increase speed of conduction. Some candidates thought that as the cat is more active it would need faster nerves. Part (ii) referred to ATP use and myelination. Many candidates spotted that the ATP would be used for active transport just at the nodes of Ranvier and that an unmyelinated axon would need active transport across the whole length of the axon.

For part (c) the answer required candidates to state how the blocking of the calcium ion channels prevented impulse transmission. Many candidates just wrote about how calcium ions act at the pre-synaptic membrane. Some lost marks for not stating which way the ions should move under normal circumstances or did not move with lead ions present.

The practical skill of drawing was assessed in (d)(i) with most candidates gaining at least two marks. The most common answers were do not shade, and do not cross label lines. Using a sharp pencil did not gain a mark as that was stated in the stem of the question. Part (ii) was well answered but part (iii) elicited some surprising answers with “simple”, “nervous net” and “peripheral” all being seen more than once.

Q.5

Part (a) required the skill of using a scale bar to estimate the length of a tapeworm in cm. The actual length is 650cm and answers in the range of 600 to 700cm were allowed. Answers ranged from 0.2cm to 1300cm.

Part (b) contained some of the most difficult questions on the paper and the marks reflected this. Good responses to part (i) included the fact that energy that could be used for producing enzymes was used for other purposes such as growth or reproduction. Poor responses to part (ii) did not realise that more hydrogen ions decreases the pH or makes the pH more acidic. Those candidates that worked that out could then work out that enzymes could be denatured so there would be less product to absorb. Top candidates also referred to carrier proteins losing their shape.

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Q.6

Responses to the QER question varied widely. There were many low scoring answers. This may be due to the fact that candidates find questions regarding the kidney quite challenging. As usual, there is some confusion as to the role of ADH with several candidates stating that it makes the walls of the collecting duct less permeable. Most tubes in the nephron were credited with being acted on by ADH in the essays including the loop of Henle, glomerulus and PCT. It would help candidates if they wrote out the full name of the structure and then use the initials of the structure afterwards. This may have helped the student who wrote about the CDT (distal convoluted tubule?).

Far too many candidates wrote about drinking distilled water raising the levels of water in the body and that this is detected by the hypothalamus. The better candidates wrote about water potential increasing. There were instances of the hypothalamus detecting sugar concentration, and the water decreasing the temperature of the blood.
Many candidates wrote about sweating during exercise decreasing water in the body, with the better candidates writing about water potential of the blood plasma decreasing due to the loss of water.

Q.7, 8 and 9

Generally, marks were lost when key details were omitted. Answers may not have been specific to the stem of the question or information provided. It is important to read the instruction in the question carefully in order to address the marks awarded.

Candidates should be able to apply basic principles and practical knowledge. On the whole, answers showed the use of a wider application of knowledge. Many showed a good grasp of basic biological principles. The use of practical knowledge was more variable and candidates need to apply what they have learned from previous investigations to new examples with greater confidence.
Evaluation of data/evidence/graphs proved the most challenging skill for candidates in each option question.

Summary of key points

1. Read the question and try to work out what is being asked before answering. Rewriting the information already given will not gain marks.
2. Do not forget your basic science. A greater concentration of hydrogen ions decreases pH. Low pH is more acidic. Do not write about amount of light, it is light intensity.
3. Always show your working out for maths questions; even if the answer is incorrect, you may gain credit for how you worked out the answer. Think about the answer. Does it make sense?

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