GCE A LEVEL EXAMINERS' REPORTS

BIOLOGY
A LEVEL

SUMMER 2022

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BIOLOGY

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COMPONENT 1: ENERGY FOR LIFE

General Comments

The majority of candidates found all questions accessible and there was no evidence that candidates found any difficulty with time. Candidates were able to demonstrate a high level of skill in the mathematical requirements of the specification tested in this paper. In an appreciable number of cases, however, the handwriting was extremely difficult to decipher. It was very pleasing that large numbers of candidates showed a depth of understanding of a topic and were able to apply information and knowledge to novel situations.

Comments on individual questions/sections

Q.1 (a) The names of the stages in the population growth curve were generally well known but many candidates described the shape of the curve rather than explaining the shape of the curve as asked in the question. Responses to 'birth rate' of bacteria were rejected, care should be taken to use correct terminology. There were excellent responses explaining the difference between the decline phase using the total and viable count, but many candidates were unable to explain why a plating technique cannot be used to show dead bacteria.

Candidates did not find any difficulty with any sections of questions (b) or (c).

Q.2 (a) Candidates lost marks in (i) for giving generalised responses such as pentose sugar or carbon, hydrogen and oxygen and in (ii) for stating that DNA was a double helix.

There were many excellent clear responses to (iii) showing a depth of understanding.

(b) Stronger candidates were able to explain why the permeability of the inner mitochondrial membrane to protons would result in the generation of heat in (i) but large numbers considered that it would result in increased ATP production which was then used to generate heat. There were many excellent responses to explain why generation of heat would lead to genetic diversity in this species.

Q.3 (a) The majority of candidates understood what is represented by the terms GPP and NPP. Calculation of the NPP was found to be easier than the calculation of GPP.

(b) Marks were lost by giving the names of excretory or egested products rather than processes as asked in the question. The calculation of secondary productivity and respiration were good, and the majority of candidates stated bacteria and fungi as two types of organisms which act as decomposers.

In (iv), there were some excellent well-constructed succinct responses, giving all points on the mark scheme. Many candidates, however, did find problems. Some tried to base their answers on rainfall, some did not address the increase in winter and decrease in summer or referred to only one season. Many just gave an account of the nitrogen cycle.

(c) Almost all candidates correctly stated that the last stage in the development of an ecosystem is termed the climax community. Questions c (ii) and (iii) were found difficult by most although there some well-structured excellent answers.

Q.4 (a) Candidates found little difficulty in calculating the efficiency of aerobic respiration of glucose in (i) and correctly stated that the energy not used to generate ATP was lost as heat in (ii).

Significant numbers of candidates correctly stated that lipids have a higher energy value in (iii) but did not explain the advantage of this in a seed. Many candidates correctly referred to metabolic water in the second part of the question.

(b) In (i) the majority of candidates were able to identify where the products of fat digestion enter the respiratory pathway.

However, in (ii), an appreciable number of candidates incorrectly stated that hydrolysis involved the addition of hydrogen to break a bond and did not use the term ‘peptide bond’. Most candidates correctly stated the stage of respiration the products of protein are most likely to enter the respiratory pathway.

Q.5 (a) In (i), a surprising number of candidates were unable to calculate the magnification of the image. In many cases this was a result of not knowing the number of µm in a mm.

The term ‘mass flow’ was only used by about 30% of the candidates in (ii) and explanations of the terms apoplastic and symplastic caused difficulty.

(b) There were some excellent responses using all points on the mark scheme but some candidates argued that the grass would be killed which would provide nutrients which would lead to an increase in biodiversity.

(c) Some candidates found some difficulty explaining why each area was divided into a grid and a random number generator was used. The response ‘to increase accuracy’ was often given to explain why the experiment was conducted several times. This was rejected.

(d) Many candidates were able to give concise well-structured reasons for all three of the listed modifications, but some found difficulty with calculating the biodiversity at different times of the year. Common errors included suggesting it would make results more reliable or to see if seasons or weather would affect biodiversity.

Q.6 (a) Many candidates found this question challenging because they mixed the use of the terms atom and molecule, but there were some well-reasoned accounts. The second part of the question caused very few problems and was well answered.

(b) There were many candidates who correctly identified what was represented by all six letters in (i).

In (ii), the majority of candidates correctly identified a reduction reaction and explained their answer.

Approximately 50% of candidates clearly explained why chloroplasts act as transducers in (iii) but for the others it was not a familiar term.

There were many excellent logically argued responses in (iv).

(c) Candidates indicated an impressive knowledge of the terms buffer and isotonic. There were some excellent responses in (iii), but many candidates described the contents of the four tubes, if they were in the light or dark and the colour change. No attempt being made to explain why each of the tubes was included.

Q.7 There were many examples of excellent essays showing great depth of understanding. Many candidates gave excellent accounts of the ways in which modern agricultural practices can lead to eutrophication. The impacts of deforestation on the environment were clearly and often passionately discussed. Ways by which the conflicts of interest between food production and conservation can be resolved did cause a problem for some leading to some waffle and repetition but in the main all three sections were answered reasonably well.

Some answers were spoilt by very detailed accounts of the effects of global warming, planetary boundaries and overfishing.

Summary of key points

Read the question before answering and for the longer questions especially the QER question quickly read it again at some point during the answer to help focus on what is required. The word ‘explain’ does mean that an explanation is required.

Responses to questions demanding a demonstration of practical knowledge are improving but marks are still being lost needlessly for example not fully understanding the difference between accuracy and reliability.

Candidates are advised to make full use of the mark allocation for each section of a question.1 mark does not require an essay.

Write answers in the spaces provided in the examination booklet. If you run out of space use the additional pages at the back of the booklet or an additional answer booklet. Always clearly state where an answer has been continued, taking care to number the questions carefully.

BIOLOGY

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Summer 2022

COMPONENT 2: CONTINUITY OF LIFE

General Comments

For the Summer 2022 series of examinations, centres were provided with advanced information on the key areas of focus for each component of this qualification. While the main focus of each paper was outlined at a high level, centres were advised that topics **not** included in the guidance could also appear in each paper, including synoptic content from other components. Centres were also reminded that core concepts, practical and mathematical skills would also be tested.

The facility factor for most questions was between 35 and 55. Those that had the lowest facility factors were testing content that was not explicitly included in the advanced notice or were testing mathematical skills (mainly statistical testing).

Comments on individual questions/sections

Q.1 (a) Part (i) asked candidates to calculate the actual diameter of a snail from a photograph given a scale bar to show size. This proved to be a more challenging question than expected. Many candidates did not ensure that measurements were in the same units or did not follow the rubric of the question which asked for the diameter to the nearest millimetre.

Part (ii) asked candidates to complete the classification of the snail. This topic was not on the advanced notice and was less well answered than in previous examination series.

(b) Part (i) asked for a definition of genetic polymorphism. This was poorly answered but again, a topic not listed on the advanced notice.

Part (ii) tested their knowledge of the Chi^2 test; specifically, the null hypothesis. It was evident that many candidates believe that this test can only be applied to genetics and most did not understand that Chi^2 tests whether there is a significant difference between observed and expected results – regardless of the context.

Part (iii) required the identification of two modes from a graph. This was answered correctly by most candidates.

Part (iv) asked candidates to apply their knowledge of natural selection. Many excellent answers were seen but there were also many answers that were poorly communicated, costing candidates marks. The low facility factor for this question (16.7) reflects the lack of clarity in candidates' answers and errors made in the use of the image, information and graph provided.
Part (v) tested an understanding of why allele frequencies change. Many candidates confused the knowledge being tested in question 1(b)(iv) and 1(b)(v) and again poor communication cost marks for many candidates.

Q.2 (a) Part (i) asked for a description of events during germination that trigger amylase synthesis. The question was in the context of a starch agar experiment and many candidates did not understand that the amylase diffused out of the seed, ie., that the starch agar had nothing to do with the amylase synthesis.

Part (ii) required an understanding of controlled variables in this experiment and the purpose of controlling variables. Again a great deal of confusion here between ensuring that only one IV was tested and improving accuracy.

(b) Part (i) asked candidates to measure the maximum diameters of clear zones and calculate a mean. Most candidates measured the diameters correctly, but many did not match the number of significant figures on the mean to the other means shown in the table.

Part (ii) tested candidates' ability to plot a graph. This is a skill that can be tested in many different contexts. Overall, the standard of answers was quite poor. Both the IV and DV were continuous and a line graph should have been drawn, not a bar chart as many chose to do. In that the question asked for the mean results to be plotted, the DV label should have included this. Axis labels otherwise should be copied from the table headings. The scale on the x axis was often not drawn as a linear scale and no numbers were given at the axis origins on a large number of graphs. While plotting the means was generally well done, it is obvious that many candidates did not understand the concept of range bars. This was also evident in many answers to part (iii) which asked candidates to explain the purpose of range bars.

(c) Candidates were asked to suggest and explain why amylase activity decreases. Many good answers were seen to this question but the link between this and the appearance of leaves was often not made.

Q.3 (a) Part (i) tested candidates' knowledge of the anatomy of the female reproductive system and the functions of different structures. They were provided with a diagram of a vertical section through the female reproductive system which may account for the many errors seen when answering this question. Many candidates did not seem to understand the difference in function between the urethra in male and female mammals in (ii). They also gave confused answers to (iii) which tested core content on ciliated epithelium and synoptic content of the functions of this tissue in the trachea and Fallopian tube. This mostly stemmed from mixing up cilia and microvilli.

(b) This tested candidates' knowledge of oogenesis and fertilisation. While many good answers were seen there also much confusion as to the stages of oogenesis and the fate of sperm during fertilisation. Application of their knowledge to different forms of IVF saw better answers (part (iii)). However, many referred to the whole sperm, not just the nucleus, being injected into the secondary oocyte. Overall, there was poor understanding of the advantage of unequal cytoplasmic division when meiosis II is completed.

Q.4 (a) Part (i) tested core content on the role of nitrate and phosphate. This question was answered well. However, poor communication cost marks as did generic answers, such as …they are needed for growth. Part (ii) tested the need of ATP for active transport of ions. This part of the question was well answered. However, few candidates could identify the endodermis (synoptic content from Comp.3). Furthermore, many candidates did not read the question stem which referred to movement of ions into the xylem; many tried to explain uptake into the root.

(b) In order to select and use correct statistical tests candidates need to understand what is meant by normal, distribution (b)(i), types of variation (b)(ii) and the type of data that are appropriate when using Chi^2 and Student's t-test. None of these questions were answered well apart from identifying continuous variation. Qu. (b) (iii) had the lowest facility factor on the paper. Candidates need to gain a better understanding of the selection and use of Chi2 and Student's t-test. This has been highlighted in previous examiners' reports.

Part (iv) asked candidates to evaluate a decision based on data provided. Many candidates described the data and did not use this to evaluate. This type of question requires sequential thinking to explain the consequences of the decision made and how to improve the decision. This question was not answered well on the whole with a facility factor of 26.7.

(c) This again tested synoptic content from Comp. 3 and reflected a poor understanding of the kidney, even though this topic was included in the advanced notice for Comp. 3. This was reflected in the facility factor of 29.1 for this question.

Q.5 (a) This tested candidates' knowledge of core concepts – nucleic acids combined with the application of this knowledge in analysis of the human genome. Candidates were asked to identify condensation reactions and bonds formed by this reaction and also to identify nucleotides based on their structural formulae. While most candidates correctly identified the condensation reaction, fewer could name two bonds formed by this reaction. Few could identify guanine and cytosine or explain their answer in terms of their structure of differences between DNA and RNA.

(b) Most candidates could state the difference between deoxyribose and dideoxyribose but lack of clarity cost marks here as did the incorrect use of the term molecules in place of atoms or functional groups.

(c) Explaining how gel electrophoresis can be used to separate DNA fragments was generally well answered but many talked about heavy / lighter fragments rather than longer / shorter fragments. A surprising number could not deduce the base sequence of a fragment or use complementary base pairing to show the bases in the complementary strand.

Q.6 (a) This tested candidates' ability to calibrate a microscope and then use this calibration to determine actual size. These questions were very poorly answered and few used the relationship 1epu = number of smd / number of epu x actual size of 1 smd. Many candidates initially calculated this correctly and then divided by 4 (the magnification of the objective lens) or did not round to the nearest micrometre as instructed. When asked to use their calibration to calculate the actual size of a structure 97epu long, again some divided their answer by 4 or did not convert their answer to mm or again, did not read the instructions to give their answer to 1dp. There was also a major lack of understanding of the need to recalibrate a microscope for each objective lens.

(b) This question tested candidates' knowledge of oogenesis and spermatogenesis. There was much confusion as to when to primary oocyte or primary follicle (iii) and even more confusion as to the role and significance of mitosis in spermatogenesis. Few candidates recognised the need for large numbers of sperm to increase the chance of fertilisation.

(c) This question focussed on sex-linked inheritance. Most candidates completed the genetic cross correctly but should be reminded that for a sex-linked condition the phenotype must refer to male or female in addition to being normal, a carrier or affected by the condition.

Q.7 The QER was basically a comprehension question testing candidates' understanding of pollination and seed dispersal in the context of dandelion reproduction. A large number of facts were provided that candidates were expected to use to identify and explain the types of pollination carried out by dandelions and to explain how the flowers are adapted to these types of pollination. They were also asked to identify and explain other reproductive strategies employed by these plants

Many candidates attempted to answer this question purely from memory with little attention paid to the information given. Long, detailed descriptions of wind pollination, gamete production, double fertilisation and seed structure / germination were given by many, all not relevant to the question. A large number of candidates used pollination and fertilisation interchangeably, and even more did not distinguish between seeds and pollen. Statements such as …lightweight seeds that can be carried by the wind to other plants where they land on the stigmas to carry out wind pollination … were common. As a result, many candidates wrote several pages of answers and gained few marks if any. This reflected in the mean mark of 3.9/9 for this question. The differences between pollination, fertilisation and seed dispersal need to be emphasised.

Candidates who gained high marks on this question clearly read the information provided, identified relevant facts and applied their knowledge and understanding to what was actually asked.

Summary of key points

Centres need to:

- as far as possible, make sure that candidates gain experience of all practicals, whether by actually carrying out the practicals or going through them theoretically – this will help to ensure that candidates learn the required skills and can apply them in theory questions

- include opportunities for students to practice mathematical skills in lessons – this includes making simple measurements, unit conversions, and drawing graphs, but especially the reasons for choosing statistical tests, how to construct and interpret null hypotheses, types of data in relation to variation; homework tasks could include questions that would reinforce some of the more challenging skills, eg., calibration of the microscope.

Candidates need to:

- read the instructions given (eg., Give your answer to 1 decimal place) to avoid making simple errors and losing marks

- use and apply the information provided (eg., the QER) to the question; relying on their own knowledge and understanding means that they will lose marks as they are not then answering the question

- make sure that they understand the meaning of different command words such as, describe, explain, conclude, evaluate and the difference between these commands.

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COMPONENT 3: REQUIREMENTS FOR LIFE

General Comments

Considering the disruption to teaching and learning the candidates have undergone in the recent past it was found that there were many good responses to the paper. All of the marking points were seen during the marking process.
As usual there were some problems with trying to read some responses. Additions to answers were difficult to read due to where they were inserted or written around answers to other questions.

Comments on individual questions/sections

Q.1 (a) The mean mark here was 0.5 which was a little disappointing as this is a common core principle question. Credit is always given if a start or stop sequence is added so an extra 3 or 6.

(b) This tended to be answered with well structured, logically sequenced responses. As always we do not accept sodium ions entering the membrane; they CROSS the membrane INTO the neurone/axon. A mark was given for threshold is reached. There was no need to give a numerical value for this.

(c) Part (i) asked for the names of the structure and process so no credit was given for just a description. Credit is given for incorrect spelling (in this case vesicle and exocytosis) but it must be phonetically close to the correct answer. Candidates who gave endo/exocytosis as an answer gained no marks.
In (ii), the best responses pointed out exactly where ATP is used. Some of the best gave the answer in bullet points e.g.
"ATP is used for

- Exocytosis
- Active transport of calcium ions out of the synaptic knob
- Synthesis of neurotransmitter"

Many of the responses that gained few marks just gave a general description of what happens at a synapse with no indication of where ATP is used. Other responses that were incorrect included the use of ATP for diffusion of neurotransmitter and for facilitated diffusion, usually of the calcium ions into the pre-synaptic neurone. ATP is used to actively transport the calcium ions out of that structure.

Q.2 (a) The most common mistake in part (i) was to round the number incorrectly. Some of the answers that gained credit included 0.07, 0.068, and 0.0677. 0.067 only gained 1 mark. Both larger surface area to volume ratio and diameter is smaller were needed for the mark in part (ii).

The most common correct responses to part (iii) included short diffusion distance and they have a large surface area to volume ratio. Answers referring to low metabolism were also seen. Unfortunately, some candidates became confused and wrote about the (single-celled) organisms having few cells.

(b) Part (i) was answered well by a few candidates who spotted that the gills moving would maintain a concentration gradient so the oxygen diffusion rate would remain high. Many candidates wrote about fish gills and counter currents. Part (ii) was a good place to illustrate the phonetic spelling of tracheoles that gained credit. For part (iii) “blood not in vessels” was all that was required for the mark. If specific vessel names were given arteries, veins and capillaries needed to be mentioned to gain credit.

Q.3 (a) Part (i) was a recall style question. In the specification for component 3, Section 3 Adaptations for Nutrition statement (b) states that the candidates need to understand “the terms saprotrophic/ saprobiotic, holozoic, parasitic in relation to heterotrophic organisms.” The ideal answer involved the internal digestion of food molecules but if ingestion and digestion were mentioned, credit was given. The majority of candidates mentioned conversion when HCl acid was present for part (ii), but the cells that secrete the pepsinogen are not damaged was also needed, not just the stomach lining.

(b) Part (i) proved to be one of the most difficult questions on the paper. The candidates needed to understand the concept of gastric emptying (GE) as described in the question. The GE of the solid protein and the sugar-rich drink were being emptied into the duodenum. Answers that just focussed on the mouth and oesophagus did not gain any credit as the question refers to the stomach and duodenum. Candidates needed to spot that the solid would need more mechanical digestion so would stay longer in the stomach. The difference in the molecules (protein is larger so has many more peptide bonds/ sugar is smaller with fewer bonds) would also lead to different GE. Some of the best answers spotted that carbohydrates were not digested in the stomach but were digested in the duodenum so would empty faster. Common misconceptions included sugar-rich drinks containing lipids, proteins and starch, sugars being digested in the stomach, and proteins not being digested in the stomach.

The most common mistake in part (ii) was neutralising stomach acid decreasing the pH so that speeds up protein digestion. Many candidates did spot that the pH is no longer acid so the optimum pH for the stomach enzymes was no longer maintained, or that the activation of pepsinogen would not occur.

(c) Protein digestion was being tested in part (i) with the use of data interpretation. Most candidates knew that endopeptidase breaks bonds in the middle of the protein and produces shorter polypeptides which gained a mark Fewer knew that exopeptidase only hydrolyses the terminal bond/removes terminal amino acids so more free amino acids were produced. The logical conclusion is that the endopeptidase produces more terminal bonds for the exopeptidase so the most free amino acids are produced when both enzymes are used together, as shown by the data. Rewriting the data is not an explanation of the results and so gains no credit.

The question for part (ii) asked how to test the "liquid to show that no enzyme had left the column." Biuret needed to be added and it will stay blue. Many candidates just gave the biuret test and stated that it would go violet with no explanation. If there's no protein it stays blue. All of the other food tests were seen. The mathematical nature of a straight line is now well known and candidates handled (iii) very well. The fact that only 2 results were used to extrapolate a straight line (iv) was also spotted to be poor science by some candidates.

Q.4 (a) The instrument used (scalpel/scissors/knife) had to be sharp for the mark. In future please can the **use** of the instrument causing cuts be used as the risk, not just cuts the skin (which was allowed this year). Use a blunt scalpel or don't cut the kidney were not allowed as answers for the control measure!

(b) Part (i) was answered well by some candidates who wrote that the increased pressure would increase filtration rates to compensate for the blocked tubules. Many candidates thought the increased pressure would force the cysts out.

Part (ii) asked about oedema in some tissues of the body. Unfortunately, some candidates just wrote about the kidney and ultrafiltration. This is a question about tissue fluid formation and the candidates that worked that out often gained full credit.

(c) This was attempted by nearly all the candidates and most gained at least 1 mark. When evaluating data it is best practice to give evidence for and against the conclusion, but 4 marks could be gained just for points against. Some candidates would have gained more marks but reached the maximum of 4.

(d) Parts (i) and (ii) were synoptic from component 2. The meaning of autosomal was well written, but the meaning of dominant allele was often confused. Poor expression tended to be the downfall of candidates; alleles don't win, they are not stronger. The dominant alleles are expressed when present was the most elegant answer. Assumptions were well recalled.

Q.5 Questions about plants often seem to be less well answered than others on component 3. It was pleasing that most candidates did attempt answers in this question up to 5bii.

(a) The answers in part (i) were often well laid out which made awarding marks to partially correct responses easier. If candidates used the diameter instead of the radius they could still gain 2 marks. If they had calculated the area of view correctly, they could still gain 1 mark.

For part (ii) examiners were looking for using counts from other fields of view from the same leaf and a way of overcoming the presence of fractions of stomata from the edge of the field of view, something they would have done in the practical.

(b) Part (i) was well answered using the data provided, as was part (ii). This was a variation in the "hairy leaves" of xerophytes type question.

(c) This caused some difficulty. The most common response was that with more CO_2 there would be more photosynthesis so more water would be used in that process and not lost. Candidates had forgotten that water vapour is lost through stomata when they are open and that they would open less if there were more CO_2 available.

(d) In part (ii) the examiners gave credit for less water is absorbed plants. Ideally the answer referred to less water lost by transpiration. Either way, more water remains in the ground making flooding more likely. Many referred to the greenhouse effect.

Q.6 The higher scoring scripts for the "essay" QER question very often had a plan at the beginning. This is a good way for candidates to arrange their thoughts before answering.

The vast majority of candidates identified an artery and a vein (arteriole and venule were given credit), but a minority had one or the other as a capillary. It was thought that the identification would be simple and that the structure and function of the vessels would be simple recall, but that proved not to be the case for some candidates.

Some points to note:

Arteries. These have thicker walls, mainly to withstand or maintain the high pressure from ventricular contraction. Elastic tissue expands and recoils, not contracts. Muscles contract to give smaller lumen.

Veins. Although the photograph does not show a valve, veins have them to prevent backflow of blood.

The question just asks for the two vessels X and Y. There is no need to write about other types of vessel.

The aneurysm in the diagram was often described well and a range of possible problems were outlined.

Option questions

The majority of candidates (almost 71%) chose to answer Question 7, Immunology and Disease, while Question 9, Neurobiology and Behaviour was answered by the fewest candidates (just under 10%) so the comments relating to question 9 are less reliable based on statistical evidence that represents fewer centres.

The mean marks were similar for the three options and a similar range of marks was also noted. With the slight exception of question 9 (Option C), facility factors were similar.

It was pleasing to observe that the content for each option had been covered and learned by many candidates despite the challenges of the previous two years. Where marks were lost, all too often, responses were not precise or candidates had not been able to use the information given in the question to support their answers.

Q.7 Option A, Immunology and Disease

(a) Various convoluted, and not always accurate, descriptions of an antigen were given in part (i). A simple statement was adequate, based on the teachers guide or the associated text book.

Most candidates understood the relationship between a virus and host cell in part (ii) and there were some clear explanations relating to viral replication. However, a superficial knowledge of cell processes contributed to answers that lacked specific understanding.

(b) Candidates gave variable, sometimes detailed, descriptions of how immunity is acquired. Many distinguished cell mediated immunity correctly and related their answers to T cell function and the subsequent production of memory cells. Too many answers meandered into descriptions of humoral immunity.

(c) In the majority of responses, candidates showed a clear understanding of bacterial cell wall structure relating to gram positive bacteria. Although most understood the significance of antibiotic resistance, many could not provide adequate explanations of how numbers of resistant bacteria increase in populations.

(d) Most candidates appreciated that only a simple calculation of proportion was required and no conversion of units needed. The magnification of electron micrographs served only to illustrate why the smaller structure appeared larger in the photomicrographs.

Q.8 Option B, Musculoskeletal Anatomy

(a) Answers here were predominantly recall. The majority of candidates identified the type and function of the cartilage at the position shown. Several answers stated more than one function with the assumption that one would be correct. Responses relating to transport were not always precise.

(b) Many candidates understood the mechanism of muscle contraction well enough to recognise that the A band remained the same size and explain the reason. Of those who stated the changing size of the H zone correctly, some described a degree of movement of actin filaments but many were unable to explain how it would reduce the size of the H zone.

The majority of candidates identified the antagonistic nature of muscle groups of the thigh.

(c) It was pleasing to note that candidates had used the information given and there were many good explanations for the selection of specific features of rats used in the experiment in part (ii).

Descriptions of conclusions from the experimental data were varied in (iii) and often unnecessarily lengthy. The majority of answers made a valid comparison of the data and some candidates stated all four marking points correctly. Several answers were merely word descriptions of the numerical data and gave no observed comparison of the effectiveness of treatments. Others lost track of the dependent variable, which was bone growth, and described vitamin D uptake. The most common error stated that a small standard deviation alone was enough to confer 'significance'. Very few recognised the importance of standard deviations that show no overlap in the ranges of data. Some answers drifted into unnecessary evaluation of the experiment.

(d) This required recall and many candidates were able to recognise the condition illustrated in the x-ray photograph. Potential causes needed to be clear.

Q.9 Option C, Neurobiology and Behaviour

(a) Candidates were able to make logical suggestions for the roles of worker termites. Responses needed to be precise when describing division of labour and stating the type of innate behaviour described in the question. Most were able to assess the advantages of such behaviour to the survival of a colony, although only the better candidates appreciated the contribution of winged individuals to dispersal.

(b) Generally, features of primate behaviour were understood. Few candidates seemed aware of the difficulties of collecting numerical data and the subjective nature of interpreting behaviour. Most correct answers to part (iv) focused on the weak correlation shown in the graph rather than the problems of data collection.

Some candidates lost marks due to misreading numbers or not using straight lines to find points on the graph.

(c) The majority of candidates understood the significance of the homunculus but lack of precision was often a cause of lost marks. The link between motor control and a greater number of muscles in the hand was not always clear. Vague references to 'more movement' were inadequate.

(d) Many candidates were able to offer a simple description of a PET scan procedure. Often this was over detailed at the expense of the remainder of the question. Few answers explained why more brain activity was indicated. Most candidates omitted to mention the conversion of detected radioactivity into an image.

A significant number of candidates were able to infer that complex speech requires thought processes.

Summary of key points

- Remember the basics: diffusion, simple or facilitated, is passive. It does not require ATP release.
- Candidates should try to be more specific in the phrasing of their responses to be clear as to what they are describing or explaining.

- Candidates should try to accurately use and recall key terminology from the specification whenever possible.
- It is worth spending a few minutes to plan the answer to the QER in order to gather ideas for what to include and avoid repetition.

BIOLOGY

GCE A LEVEL

Summer 2022

PRACTICA ENDORSEMENT

General Comments

The recent pandemic necessitated changes to the way in which monitoring of Practical Endorsement was conducted. Monitoring was carried out remotely which meant that practical lessons were not viewed. All other aspects of Practical Endorsement were monitored as they would have been if the monitor visited the centre. However, centres should note that we will be moving back to face-to-face monitoring from September 2022.

The pandemic also meant some requirements of Practical Endorsement were relaxed. The modification for summer 2022 allowed candidates to be awarded a Pass in Practical Endorsement if they had demonstrated competence in all of the Common Practical Assessment Criteria (CPAC) routinely and consistently, even if they haven't completed the usual minimum requirement of practical activities. As centres move back to normal working it is expected that this relaxation of Practical Endorsement will be removed.

Although the last few years have been difficult times for centres, we have still seen centres maintain a good practical programme as part of their delivery of the specification. There are several key features which characterise centres which successfully implement practical endorsement:

- Clear planning of practical work. A good plan identifies not only when specified practicals will be conducted but also states the specific CPAC that will be assessed. The plan may be part of the Scheme of Work or a separate document.
- Planning allows for the development as well as the assessment of skills within Practical Endorsement.
- Accurate Teacher and Candidate Records are maintained and updated regularly.
- Practical books are used in 'real time' at the bench by candidates when completing a practical. We do not expect to see practical books which are in immaculate condition! Candidates should not write on scraps of paper and later copy the work up neatly into practical books.
- Candidate work is annotated showing where the candidate achieves or fails to achieve a CPAC, (e.g. with *CPAC 4*✓ or *CPAC5(b)* ✗*).* If they do not succeed the candidate is given brief feedback so they have a better chance of getting it next time.
- Centres mark candidate work 'not achieved', where necessary. We do not expect to see every candidate getting every criterion each time they are assessed! Indeed, when this happens there will be legitimate concerns about whether the work has been appropriately assessed. There should be a progression. The key question is, 'Is the candidate competent at the end of the course?'

Comments on individual questions/sections

CPAC statements

Centres are reminded that in order to award a pass for Practical Endorsement, a candidate needs to 'consistently and routinely meet the criteria'. This means there needs to be evidence of multiple occasions where a candidate evidences a pass for each CPAC statement. It is important that suitable opportunities have been built into the assessment plan which allow candidates to generate this evidence.

It should be noted that candidates can work in groups when assessed. However, each candidate must generate suitable evidence that he or she independently meets the criteria. Centres need to give careful consideration to how group work is conducted so that individual candidates can be assessed on their own performance.

CPAC 1

The assessment of this CPAC requires the candidate to correctly follow written instructions to carry out an experimental technique or procedure. If a teacher feels it is necessary to intervene and correct a candidate's technique etc. then the candidate should not be awarded the CPAC.

This is a difficult CPAC for a monitor to comment upon remotely. In the vast majority of cases the monitor accepted the teacher's judgement unless there was strong evidence to suggest the CPAC was incorrectly awarded.

CPAC 2

This is the most difficult CPAC for candidates to evidence since it involves higher level skills. Please make sure that you know where and when you are going to assess this CPAC. It is also important that sufficient time is given to candidates to develop the necessary skills before assessment occurs. Generally, we do not expect to see this CPAC assessed in the first two terms of an A level course. However, we do expect to see evidence of some assessment of this criterion by the end of the first year of the A level course. This skill may be evidenced by a candidate planning to carry out a procedure and then adapting their approach as necessary.

It is not necessary to assess every element of CPAC2 each time this CPAC is assessed. However, it is a requirement that each element of CPAC 2 is met during the course. If you are monitored, the monitor will look at the coverage of each element.

CPAC 3

There is no need to assess this skill every time a practical is completed. Do **not** use practical work to assess this where hazards are minimal; rather select practical work where there are some meaningful hazards / risks.

CPAC 3(a) requires candidates to identify hazards and assess the risks associated with the hazards. A simple written risk assessment is the easiest and best way of evidencing this aspect of the skill.

CPAC3(b) should be assessed by observation of candidates conduct during a practical session.

CPAC 4

CPAC4(a) making accurate observations. We noticed a few centres awarding this element of the CPAC where the evidence in the candidate work showed that they were not working to the required standard.

Observations should be made directly into candidate practical books. They should not be written on to scraps of paper and copied up later. Please **avoid** using templates for tables that direct candidates how to record data. Templates may be useful to teach candidates a good approach to recording data early in the course but when it comes to assessment candidates **must** devise their own tables. If you give the candidate a table, then CPAC4 cannot be awarded. Where necessary, remove table templates to allow candidates to construct their own. The tables which candidates construct **must** have appropriate headings and units, where relevant. The units must be written in the table column head and not in the body of the table. If units are missing, do not award criteria.

CPAC4(b) obtaining accurate, precise and sufficient data ..... Please carefully check candidates' data. Is it recorded to appropriate precision? We still notice that some centres are too lenient on this. If data readings are not always consistently recorded by candidates, then do not award the criteria. Make sure that recordings are to the correct number of decimal places. Is there sufficient data? Is the data what you expect? Please set suitable standards at the beginning of the course. It does not matter if a candidate did not always achieve the criterion.

CPAC 5
This important higher-level skill should be assessed from early on in the course. There is no shortage of suitable assessment opportunities.

CPAC 5 has two elements:

(a) Uses appropriate software and/or tools to process data, carry out research and report findings.
(b) Sources of information are cited demonstrating that research has taken place, supporting planning and conclusions.

CPAC5(a) There should be evidence of candidates processing data using graphs and calculations. Centres should require candidates to use software (e.g. Excel) to draw graphs on a number of occasions.

Make sure graphs are constructed correctly, i.e. there is a title, each axis is correctly labelled, points plotted correctly, an appropriate scale used, etc. Candidates will need to be shown how to use Excel to correctly title graphs etc. It is evident that candidates do not always know how to use Excel appropriately.

Processing data also involves carrying out calculations. This may involve transformation of data using mathematical equations, statistical analysis etc.
CPAC5(a) also includes 'carry out research and report findings'. The report does not need to be long; it may simply the conclusion they draw from their data. However, neither is it is not appropriate to award this CPAC for a one-word answer. A conclusion requires a reasoned response to the data observed.

CPAC5(b) Candidates must show evidence of referencing sources of information. This aspect of CPAC is still not getting enough attention from many centres and is generally still poorly evidenced in candidate work. Just a few centres are to be commended for having candidates demonstrating referencing on multiple occasions; a few of these even using the Harvard System (which exceeds our requirements for this CPAC).

Opportunities for assessing referencing **must** be built in from early in the course. The information referenced may be, for data or a quote; the information may come from a textbook, journal, website EDUQAS data sheet.

Summary of key points

Practical Endorsement should be a servant to the subject. If Practical Endorsement is done well then it should assist in making better biologists. Use it to this end. Do not let it become an end in itself.

Successful delivery of Practical Endorsement needs careful thought and planning. Make sure that there are ample opportunities for candidates to evidence all aspects of each CPAC statement. We do not expect candidates to achieve CPAC statements every time practical work is assessed. Where CPAC is met every time by all candidates then that is an indicator that a centre may not be appropriately assessing.

Ensure that candidates are engaged with Practical Endorsement. PE and its assessment should be explained at the beginning of the course. In addition, candidates must be clearly informed which CPAC that are assessed in a particular practical session.

Where a team of teachers deliver biology, there must be evidence that candidate records are monitored to support standardisation across all subject teachers. This is a requirement that is noted in the monitor's report and must be implemented for a centre to pass the monitoring visit.

Please also remember that candidates must be informed whether they have achieved Practical Endorsement before the centre submits outcomes to Eduqas in accordance with JCQ requirements. Eduqas will not change centre gradings if a centre has passed the monitoring visit.

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