GCE

Rewarding Learning

Chief Examiner's Report

Biology

Summer Series 2017

Foreward

This booklet outlines the performance of candidates in all aspects of CCEA's General Certificate of Education (GCE) in Biology or this series.

CCEA hopes that the Chief Examiner's and/or Principal Moderator's report(s) will be viewed as a helpful and constructive medium to further support teachers and the learning process.

This booklet forms part of the suite of support materials for the specification. Further materials are available from the specification's microsite on our website at www.ccea.org.uk.

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GCE BIOLOGY

Chief Examiner's Report

The first AS papers of the new specification were taken in Summer 2017. The format of the AS 1 and AS 2 papers was similar to equivalent papers in the legacy specification, each with 60 marks in Section A and a 15-mark QWC question in Section B. However, as the content in the specification has been changed and reordered this was bound to be reflected in the content tested in each of these papers. Additionally, with a new AS 3 (practical skills) paper in place, practical activities detailed in the specification are no longer going to appear in AS 1 or AS 2 papers. The AS 3 'Practical Skills in AS Biology' paper was generally well done, although as expected, there was a greater spread of marks than was previously the case when the third AS unit was coursework only.

Overall, candidate performance was strong across the suite of papers and this report will provide detailed information on how candidates performed in each paper; information that will be useful to teachers/lecturers and candidates preparing for future examinations in this subject.

Each of the papers proved to be effective in discriminating among candidates of different abilities.

Online marking was introduced to GCE Biology, both at AS and A2, in 2016. While this change should not affect candidates unduly, it is important to emphasise again that they complete graphs, drawings, block diagrams and similar answers in black pen so that their work can be clearly seen by examiners following scanning.

Assessment Unit AS 1: Molecules and Cells

This paper provided good coverage of the specification and provided differentiation for a wide range of ability levels, with a significant number of marks accessible to those at a lower ability level. There was evidence that candidates, in general, clearly understood what was expected in answering each question and it also appeared that candidates had sufficient time to complete the paper. The paper contained a variety of stimulus material, including diagrams, tabular results and prose, and as always, candidates coped well with this.

While some questions were reasonably challenging at this level, for example, Question 3 (b)(i), Question 4 (c), Question 7 (b)(ii), Question 8 (a), others were very accessible, for example, Question 1, Question 2 (c) and Question 8 (b).

It is particularly encouraging to note that many candidates performed well in several of the questions involving application of knowledge in novel situations, for example, Question 5 (c) and Question 7 (c).

Q1 While this was a reasonably straightforward first question, answering correctly required candidates to know the components of both prokaryotic and eukaryotic cells. While a majority achieved at least four marks in this question, some did fail to correctly read the question and did not insert an 'X' if the component was absent. In addition, a minority of candidates failed to gain credit in Part (b).

Q2 This question on fatty acids and triglycerides tended to be well answered in general. However, a number of candidates had difficulty with several question parts. In Part (a) there were often vague references to double bonds, without actually mentioning carbon; in Part (b)(ii), a number of candidates were unable to fully describe the difference between a phospholipid and a triglyceride with some failing to make reference to the addition of a phosphate group and simply stating that 'a phospholipid has two fatty acids rather than three'.

Q3 This question was very discriminating and allowed candidates of all abilities to achieve some marks. Many candidates found the calculation for Part (a) difficult. However, allowing errors to be carried forward ensured that a majority of students did achieve at least one mark. Candidates should remember to be accurate when carrying out calculations and it is preferable to see answers to two decimal places. Part (b)(i) proved to be very discriminating and only a small number of candidates achieved all three marks. Many candidates missed the important cue in the stem of the question which stated that the 'aim of the treatment is to reduce the viral load below 50 particles' and so a significant number of candidates stated that because the viral load dropped initially it was effective at the start but then wasn't as effective after three months (due to the viral load increasing). Consequently, while many candidates did achieve two of the three marks it was only those that evaluated the results in terms of the 50 particles per cubic centimetre that were able to achieve full marks. This misunderstanding then followed through into Part (b)(ii) with many candidates stating that as the drug was effective it could be used for two months and then take a break for two months and then use it again, again missing the fact that viral load was not being lowered effectively with this treatment dose alone. In Part (c) it was obvious that many candidates are insecure about the exact meaning of the terms reliability and validity and how to apply them to novel situations. Frequently they listed possible controlled variables or vague statements about taking many blood samples rather than testing the same sample several times. It is pleasing to report that the majority of candidates were able to answer Part (d) well, clearly having a good understanding of the mechanism of reverse transcriptase.

Q4 This question covered cell division. Part (a) was generally well answered with a majority of candidates identifying the stage as metaphase. Part (b) was an excellent discriminator; many students struggled with converting this phase in mitosis to the equivalent in meiosis and consequently there were frequently many more than three chromosomes drawn. Those that did draw three chromosomes often missed the fact that they needed to be of different sizes; however, these candidates were generally able to achieve one mark for having them aligned on the equator. In Part (c) a majority of candidates were able to describe two features contributing to genetic variation, but only a minority were then able to explain the outcome of this and how genetic variation was actually achieved. Part (d) drew on material new to the revised specification and it was pleasing to see that it was well answered.

Q5 In Part (a) a disappointing number of candidates made reference to middle lamella and chlorophyll in their answers, suggesting that they had failed to read the question correctly and had missed the fact that they had to identify the compound. Part (b) was in general well answered; common mistakes involved the inclusion of 1-6 glyosidic bonds or confusing β glucose with β pleated protein. Part (c)(ii) was another discriminating question with only the more able candidates getting the idea of the thylakoid displacement; however, many did get the fact that light absorption had been reduced. Many candidates struggled to make the comparison between mitochondria and chloroplasts in Part (d).

Q6 This question on water potential showed that there is still much confusion among the weaker candidates in their ability to understand the concepts of solute potential and water potential. Part (a) was usually well answered although there were a few references to glycogen in Part (i) and a surprising number of the candidates either failed to reference the movement through a semi-permeable membrane or answered in terms of concentration rather than water potential in Part (ii). At AS level, candidates are expected to provide answers involving osmosis at a level beyond differences in concentration of the solute. Parts (b)(i) and (ii) tended to be well answered with many candidates achieving two or three of the marks

available. However, many candidates did lose marks in these question parts, due to their insecure understanding of water potential and the direction of movement of water. Part (c) appeared to be quite discriminating with only a minority of students identifying the fact that the CFTR glycoprotein was not functioning normally. Additionally, the fact that many candidates continued to frame their answer in terms of the ileum rather than the respiratory tract raises the question of whether candidates are taking the time to read questions properly rather than skimming through the stem.

Q7 In the penultimate question, candidates were assessed in a number of skills, including the drawing of a graph. It is pleasing to report that a majority of candidates were able to achieve at least three of the four marks in Part (a), and many achieved full marks in Part (b)(i) (plotting a graph). However, there still appear to be many candidates who struggle with choosing an appropriate graphical technique and consequently a number of bar graphs were submitted for assessment. Part (b)(ii) proved to be an excellent discriminator with a majority of candidates being able to describe the trend shown in the graph. However, only a minority of them were then able to extend this to explain why this trend occurred, showing that they were unable to make the link between the zinc cofactor and the functioning of an enzyme. In Part (c) candidates were much more successful in applying their knowledge to a novel situation with a significant number achieving full marks in this part.

Q8 This question on microscopy techniques and the structure and function of the ileum proved to be very discriminating. Many candidates had a thorough knowledge and understanding of both topics and were able to score accordingly, while others had only a superficial knowledge of microscopy or failed to relate the structure of the tissues to their function within the ileum. This underlines the need for a thorough knowledge and understanding of all parts of the specification for those who are seeking a top grade in this subject. In Part (a) candidates were required to explain in sufficient detail the advantages and disadvantages of the light microscope and those of the transmission and scanning electron microscopes. While a number of candidates had obviously studied this topic in detail and were able to confidently discuss the different varieties of microscopes, a majority were only able to give vague points such as ‘light microscopes are easier to use’ or included terms they had heard but it was obvious they had limited understanding, for example, ‘the inclusion of artefacts in electron micrographs is an advantage’. In Part (b), it was clear that many candidates had a good knowledge and understanding of the structures of the tissues and were able to link these structures to the functions within the ileum and so many performed better in this section. However, it was obvious that a minority of students, although familiar with the tissue layers, were unsure of what each of these layers actually did in a working ileum. The inclusion of the new banded mark scheme for marking the essay has continued to allow for good differentiation among the candidates.

Assessment Unit AS 2: Organisms and Biodiversity

There was a wide range of marks awarded to candidates in this paper. Those obtaining high marks displayed a sound grasp of the subject content and well-developed skills in application. Many candidates lost marks due to their inability to express and communicate their biological knowledge clearly. Additionally, there was evidence that some candidates did not read the questions carefully enough resulting in the answers provided not always answering the questions as asked. Comments on individual questions and their responses appear below.

Q1 This question on classification was well answered by a majority of candidates. This style of question was novel for testing this topic but it proved accessible to most students. Credit was given to those candidates who were unable to spell protoctista or prokaryote accurately, but who could produce an answer that was broadly phonetically correct. Kingdom prokaryote was incorrectly named monera or bacteria by a surprisingly large number of candidates. Part (b) was designed to assess new material on the specification and surprisingly only about half the candidates answered this question correctly.

Q2 This question assessed candidates' knowledge of the electrical control of the heart and conditions that may affect it. This was well answered by a majority of candidates as it is a familiar part of the course. Part (a) was straightforward and, in general, very well done with most candidates gaining three or four marks. Candidates less secure in their knowledge still managed to achieve some of the marking points, often including identifying the AVN, with very few zero marks awarded in this section. Marks were lost if candidates failed to indicate the direction of the electrical wave through the bundle of His and the Purkinje fibres. Part (b) provided some discrimination as students needed to look carefully at the ECGs provided and give an answer with sufficient detail. Candidates who lost this mark either failed to link the missed heart beat to a reduced oxygen supply or referenced an irregular heart beat which was incorrect in this context.

Q3 This question on biodiversity resulted in a wide spread of marks across the candidature. A small minority of candidates obtained full marks. In Part (a), candidates had to use the graph to describe and explain the effect of herbicides on biodiversity. A majority of candidates gained two marks in the description section by correctly identifying the trend and linking this to a reduction in biodiversity. The final two marks were for the explanation; only a small number of candidates picked both these marks up, often due to lack of detail. Surprisingly, a significant minority of candidates still equate a high Simpsons' index to high biodiversity! Part (b) was a familiar question on promoting biodiversity through correctly managing hedgerows by regulating their cutting. Many candidates achieved full marks in this section. However, a number of candidates lost marks through not reading the question carefully enough and provided general hedgerow management strategies such as cutting every 2/3 years (and therefore not answering the question as asked).

Q4 This question on breathing in mammals was surprisingly not well answered; sections (b) and (c) particularly proved challenging. Section (a) was a very familiar question covering content also covered at GCSE. Most candidates achieved two or the full three marks in this section. Those who lost marks commonly gave GCSE level answers and mixed up the thorax and lungs when referencing volume and pressure. In Part (b) the interpretation of a novel graph proved more of a challenge. In Part (b)(i), a majority correctly answered exhalation but a surprising number of candidates incorrectly answered inspiration, indicating an inability to link a decrease in volume in the lungs to exhalation, even though this was clearly indicated on the graph. Part (b)

(ii) was often well answered, although a number of candidates lost marks by failing to answer in terms of breathing (as asked in the question stem) and answering in terms of volume. In Part (iii) a majority of candidates referenced the increased breathing rate and so achieved one mark for this. The second mark was harder to achieve as students frequently gave answers which lacked detail. Part (c) proved to be a good discriminator; Part (c)(i) was very straightforward and the majority of candidates recognised that individual D had the largest range – however, it is clear that all not candidates are familiar with the term range. Section (ii) demanded a higher level of thinking, as students had to interpret data from the table and give detailed biological explanations for these in relation to the condition emphysema. Most candidates achieved the mark for recognising the higher breathing rate but many missed the increase in the breathing rate over the four weeks. While candidates struggled with the detail required to achieve full marks in this section, there were some excellent descriptions of the loss of elasticity in the alveoli and good descriptions of how this caused a reduction in surface area.

Q5 This question on plant transport proved most challenging to students and again produced a good range of marks. This question on an unfamiliar investigation tested students' ability to correctly link their biological knowledge on translocation to explain the data given in the diagram. In Part (a) a majority of candidates correctly identified the phloem and sucrose. However, a surprising number confused phloem with xylem and many made the mistake of thinking the organic substance was glucose or cellulose. Part (b) proved particularly discriminating with only a very small number obtaining all four marks. Many candidates failed to recognise the aim of the investigation and referred to the movement of carbon dioxide through the plant. Only a small number of candidates correctly used the data given in the diagram to identify that more sucrose moved down the stem than up. Those who referenced movement up or down often failed to take it a step further to fully explain where the sucrose moved to (fruit/flower or tuber/bulb).

Q6 This question on pollution, material new to the AS section of the specification, proved a challenge to many candidates. In Part (a)(i), the point at which slurry entered the river was correctly identified by a majority of candidates (although many failed to put the arrow on the x-axis as instructed in the question). Part (a)(ii) was well answered by those students who recognised it was organic pollution and not eutrophication and provided A-level detail in their answers. Many candidates failed to fully describe the decrease in oxygen as they often failed to indicate that there was a large and sudden decrease. This point has been made in previous reports (when pollution of waterways was an A2 topic); it is important that this type of feedback is relayed to AS candidates. Many candidates lost a mark for reference to the slurry as 'food' - a better answer was to identify the slurry as containing organic nutrients for the bacteria. Many candidates failed to identify the fact that the bacterial population would increase exponentially with access to this sudden increase in nutrients. Candidates did link the falling oxygen levels to respiration by bacteria and so obtained this mark. A number of candidates confused organic pollution with inorganic pollution, making reference to algal blooms and their decay. However, this did not disqualify candidates from accessing marking points three and four. In Part (b)(i), candidates' maths skills were tested. Candidates had to use data from the graph and work out a percentage change in oxygen content of the river between two points. This was often very poorly done, indicating that many candidates struggle to calculate parentage changes, even though this is a skill often tested at GCSE level. Some candidates did gain one of the two marks for selecting the correct data and knowing which value to subtract from the other. Part (b)(ii) was often poorly done as many answers were not given in enough detail; many just stated there would be less slurry, without any reason for this. A significant number of candidates did recognise that with less slurry there

would be less bacteria and so this would explain the rise in oxygen content of the water. Part (b)(iii) was generally well answered with most getting the idea of more samples between the two points. There is further evidence that some candidates are still confusing validity with reliability and just suggested repeating the samples. Part (c) proved to be the most challenging part for candidates and the frequency of vague answers indicates that the differences between these two types of pollution is not well understood. Few candidates achieved more than one mark in this section - the point linking inorganic pollution to algae blooms. Many candidates gave good descriptions of the types of pollutions but failed to hit on the A-level detail required to gain the marks. Few identified the time factor in both these types of pollution, either the initial onset of the effects of the pollution or their duration.

Q7 This question on the circulatory system, blood clotting and oxygen dissociation curves was generally well answered although again providing a good spread of marks. Part (a)(i) focused on the adaptations and functions of the capillaries. Many answered a large surface area, which on its own was not enough, as they also needed to give the reason why there was a large surface area, i.e. the vast network of capillaries. In Part (ii) candidates had to use a diagram to answer a question on transport in the plasma. This was again poorly answered as many candidates mixed up arteries and veins or suggested that oxygen is carried in the plasma. A majority of candidates obtained one of the two available marks. Many obtained the 'suggestion' mark with reference to different glucose or carbon dioxide levels but failed to explain what caused this difference and so lost the second mark. Part (b) asked candidates to relate their knowledge of blood clotting to the function of factor VIII. This was a familiar question and many candidates obtained both marks, with those that did not frequently just giving knowledge of blood clotting but no reference to factor VIII as asked for in the question. The spelling of blood clotting proteins was often poor, but phonetic spelling was credited if it was clear which protein was meant. Part (ii) was correctly answered by a majority of candidates. In Part (c) candidates had to interpret a graph showing the oxygen dissociation curves for three mammals. This style of question was commonly used in the legacy specification and it was clear candidates benefitted from this familiarity. Part (i) was very well answered with most candidates getting full marks. A common failure was to get the affinity the wrong way round and suggesting that the mole had a lower affinity. Some candidates failed to link the information in the question stem on the narrow burrows to lack of oxygen and referred to the moles metabolic rate. Part (ii) was well answered with a majority of candidates accessing two of the three marks. The last mark was frequently missed due to lack of detail in answers about the oxygen demand of the respiring tissues. It was interesting to see that many candidates could not link high metabolic rate to high respiration in tissues and so a larger oxygen demand. Many candidates also referenced the Bohr effect as causing the shift, while incorrect in this context, it was treated as neutral during the marking process.

Q8 Section B (the essay) assessed candidates' knowledge and understanding of transpiration and xerophytic/hydrophytic plant adaptations. The new banded mark schemes provided a much wider range of marks and provided the opportunity for weaker students to access some marks while appropriately rewarding candidates who gave in-depth detailed answers top marks. In Part (a) candidates were provided with information on the habitats of two different plants found in Northern Ireland. Despite the unusual context, candidates gave some very good answers; the majority achieving four to six marks. When giving answers for *A. arenaria* most candidates had a good understanding of the xerophytic adaptations and gave some excellent detailed descriptions of diffusion shells. A small number of candidates incorrectly referred to hydration shells and lost marks. The most common marks were for curved leaves and sunken stomata with very few candidates going down the route of succulent tissue. A

surprising number of candidates failed to read the question correctly and gave their second adaptation in reference to roots, which resulted in them losing two marks. Candidates knowledge of hydrophytic adaptations was generally less secure. Many could name the adaptations but could not explain how this was of benefit to *N. alba.* Many candidates confused the information suggesting they needed more stomata to get rid of water. It is worth noting that if candidates failed to identify any hydrophytic adaptation they could only achieve a maximum of two marks in this section. Part (b) required candidates to describe and explain environmental factors that influence the rate of transpiration in a typical plant. This was very well answered by the majority of candidates. There is still evidence that candidates are still not differentiating between the evaporation from the spongy mesophyll and diffusion of water vapour out of the stomata, many still refer to evaporation out of the stomata and lose marks. The most frequent loss of marks was the lack of direction when describing the environmental condition. For example, temperature and wind speed were often described as increasing transpiration, when it should be increasing temperature and wind speed. A minority of candidates stated that water enters the stomata when humidity is high so transpiration then increases. Another misconception was that in high light intensity, transpiration was lower as water was used for photosynthesis. To achieve full marks candidates needed to have included at least four of the five factors indicating excellent and detailed knowledge and understanding of this section of the specification.

Assessment Unit AS 3: Practical Skills in AS Biology

Assessing practical skills in a written examination is a significant change in the Revised Specification. The rationale for introducing a 'practical' assessment tool in this form was twofold:

- to encourage and facilitate the development of practical skills in students, and,
- to provide meaningful differentiation across the candidature in the assessment of practical skills.

This fifty-mark paper covered many of the practical activities identified as being part of the AS course.

Q1 This three-mark introductory question tested the use of qualitative reagents in identifying biological molecules. As anticipated it was well done by a majority of candidates. Part (b) was the least well answered part as many candidates made reference to the colour change of the Benedict's reagent only without making reference to the formation of a brick red precipitate.

Q2 Knowledge of the colorimeter, serial dilutions and calibration curves were all tested in this question. Only a small minority of candidates scored well across all three components of the question. In Part (a)(i), a small number of candidates indicated that 1cm^3 of 1% starch should be added to 10 cm^3 water (rather than 9 cm^3). Other candidates lost the mark by referring to a continual series of dilutions which would produce concentrations much less than the 0.1% asked for in the question. Part (ii) proved demanding for many students with methods of preventing contamination the most common correct answer. Very few candidates made reference to ensuring that the initial (stock) solution was thoroughly mixed/stirred, or the importance of using apparatus of the appropriate precision when carrying out serial dilutions. Part (b) also proved demanding for many candidates with a significant minority suggesting that amylase was added to the starch in order to produce the starch concentrations required for the calibration curve. A minority of candidates also referred to the construction of calibration graphs as starch concentration against percentage transmission.

Q3 Rocky shore sampling was covered in this six-mark question that tested both understanding of ecological investigations and graph data analysis. This question proved to be very discriminating; some candidates appeared to have a full understanding of the principles' involved while others appeared to have very little understanding of ecological techniques. In Part (a)(i) many candidates were able to answer that systematic sampling was the appropriate method when zonation was present. However, a sizeable minority then went on to disqualify their answer by adding that the zonation was from the rocky to the sheltered shore, rather than within each type of shore. In Part (a)(ii) most candidates could appreciate that rock pools should be avoided when setting up transect lines as they would provide atypical habitats (as they were less affected by the tides) than other parts of the shore. Part (b)(i) asked candidates to analyse graphs of *Ascophyllum* distribution on each of a rocky and sheltered shore and give a similarity and two differences between the shores. Marks were often lost for poor expression as the answers were often unclear. Additionally, candidates were expected to give overall conclusions. For example, answers such as 'in the sheltered shore at position 20 m there was 82.5% cover, whereas there was no *Ascophyllum* present at 20 m on the exposed shore,' failed to gain credit. Only a very small number of candidates could 'use (all) the information provided' and link the information in the stem of the question regarding the seaweed being attached to underlying rock to possible reasons for the percentage cover being less on the exposed shore, i.e. the stronger tides detaching the seaweed from the rock.

Q4 Determining the average solute potential of onion cells at incipient plasmolysis was the subject of this question. Able candidates often achieved full marks in this five-mark question. In Part (a) many candidates were able to answer that in order to calculate the percentage of cells plasmolysed it is crucial to know the total number of cells observed/counted. However, a surprising number stated that the percentage of non-plasmolysed cells had to be calculated. In Part (b) candidates had to complete a graph – this was often well done. The most common plotting error was failure to plot the 0,0 point. The 'line' mark was often lost through joining the points with straight lines (rather than a best fit line) or failing to have the line going through the origin. Part (c) was usually well done but marks were dropped through inaccurate reading of the graph scale or failing to add the negative symbol.

Q5 This short four-mark question involved a calculation requiring candidates to calculate percentage soil moisture from data and the measurement of a named edaphic factor. The calculation in Part (a) proved difficult for many who failed to take account of the mass of the container in their calculations. Rounding errors were frequent. Most candidates could state how to measure an edaphic factor of their choosing in Part (b).

Q6 Mitosis in root tips was the topic for this question. In Part (a) candidates were asked to describe how to prepare a microscope slide to show mitosis in root tip cells. Many candidates did very well obtaining all or most of the available marks. Most candidates were able to describe how to obtain suitable roots, stain the cells and prepare a root tip squash. Marks were often lost when candidates were unsure of the exact sequence of events or through providing answers that lacked sufficient detail such as a lack of accurate knowledge of suitable stains. Part (b) (i) asked candidates to draw a cell in the final stages of mitosis and label three structures that were visible in the photograph. Drawings were often well done but many candidates lost marks through failing to draw chromosomes as individual entities, with many candidates drawing a membrane-bound nucleus lacking detail. For Part (b) (ii) candidates gained credit for answering either telophase or cytokinesis.

Q7 This question tested candidates' knowledge and understanding of a typical enzyme-based practical. In Part (a) candidates were asked to tick those variables that should have been controlled in the catalase investigation described, to ensure validity in experimental design. A surprisingly high number of candidates ticked enzyme concentration, which of course couldn't be controlled in this particular investigation and was indirectly the independent variable. In Part (b) only a minority of candidates obtained full marks in completing a table suitable for recording results from the investigation. Many lost a mark through not identifying a column heading as 'maximum height of froth' (frequently answering 'height of froth'). Part (c) was very poorly answered. Many candidates looked at the experimental set-up rather than the method used for recording results. Additionally, a significant number of candidates described two suggestions, rather than covering the apparatus/recording device and then a justification for how it could be changed. Part (d) proved much more accessible. However, a disappointingly high number of candidates didn't extend their answer beyond increasing surface area.

Q8 The final question on the paper tested candidates ability in calibrating an eyepiece micrometer and their understanding of its use in measuring cell lengths. Part (a) (i), a calibration calculation, was well done by a majority of candidates. A minority of candidates mixed up the values for the eyepiece micrometer and the stage micrometer. Many candidates lost marks through not getting the final answer correct but then failing to gain 'working out' marks by failing to show their working out, or failing to show it in a meaningful way. Parts (a)(ii) and (b)(i) were well done. Part (b) (ii) was also well done with most candidates gaining at least two of the four marks available. Where marks were lost it was often through a lack of detail.

Principal Moderator's Report

The new requirements for the revised specification were well embraced by the majority of centres and many centres and candidates spent a great deal of effort in the production of detailed practical booklets/lab manuals. There was great variation in the presentation of the samples with there being a mix of lab manuals, folders, project files and stapled sheets. Some reports were comprehensive whilst others had the basic requirements necessary to satisfy the evidence.

The aim of this section of Unit 3 is to ensure candidates have had a chance to develop their practical skills and also gain a thorough understanding of all the listed practicals to enable them to answer the questions in the practical examination paper. It was obvious from the samples provided by some centres that the candidates had analysed each of the investigative practicals to include interpretation and evaluation and they had a good understanding of each of the practical tasks.

Interestingly the moderation team felt the quality of tabulation of data and graphical presentation was of a lesser standard than previous years. Maybe this is a result of centres not trying to fulfil specific criteria as in the previous specification.

The Moderation team will look more closely at the marking of practical tasks containing tables and graphs. Whilst some small errors can be ignored it is felt that producing tables and drawing graphs are a key component of undertaking practical work. Errors such as incorrect scales, incorrect lines, incorrect plots etc. should be penalised a mark.

Whilst in the majority of centres the evidence clearly indicated that the candidates had carried out the practical task, in some centres it was not evident that the candidates actually carried out the practical work. Evidence should be such that it is obvious the candidates have performed the practical task.

Identification of biological molecules:

This task should involve more than just carrying out the basic food tests (which is GCSE level!). Many schools incorporated the identification of biomolecules in unknown samples or the molecules present in certain food types. Results tables as evidence should be constructed by the candidates and not simply copied from the guidance booklet.

Chromatography:

Many centres had difficulty getting suitable separation of amino acids which made it difficult to calculate Rf Values. It is acceptable to photocopy successful chromatograms for other candidates to use. The use of common chromatograms should be made clear in the samples and a copy of the candidates own/group chromatogram should be included in the sample. It is not acceptable to use a typed chromatogram (for example from the internet or past paper question) to calculate Rf values.

Enzyme practicals:

These were very well completed by the candidates and were generally variations of previous enzyme practicals used for coursework. There were some centres were the quality of graphs were not of AS standard and some of the conclusions were basic. Whilst these pieces of evidence were sufficient it would be beneficial to the candidate if they were encouraged to be more detailed and accurate in their interpretation etc.

It is important that the investigations focus on one of the factors which influence enzyme activity.

For enzyme immobilisation some centres provided photographs of their completed apparatus as well as the outcome of their results. This was well appreciated by the moderation team.

Use of a colorimeter:

At AS level there is no requirement to use semi-log graph paper to draw the calibration curve (there is at A2 level). Most candidates drew graphs with a linear scale however some centres used a dilution factor of a half which made the graph drawing more manageable. Identification of unknown starch concentrations would be suitable as a follow on to the serial dilution.

Factors affecting the permeability of beetroot membranes was a very common practical and many candidates provided excellent conclusions which demonstrated a solid understanding of the biology underpinning the effects of these factors.

When using a colorimeter during an enzyme experiment this cannot be used to represent two of the practicals for submission i.e. enzyme and colorimeter. There must be inclusion of seven practical elements to fulfil the requirements for the teacher assessed component.

Graticule and stage micrometer:

Many centres did not choose to do this practical probably due to not having the apparatus to carry out this particular skill. On the occasions that it was attempted many candidates photographed the particular cells being measured using a phone or tablet. This was well appreciated by the moderation team as it showed clear evidence the candidates had carried out the actual practical task.

However, in some centres all the calculations were exactly the same indicating only one slide and field of view was used by all in the centre. If there is only one graticule for the centre the candidates should be encouraged to use a different field of view in order to do their measurement of the cells. It is important working out for the calculations is clearly shown. What is not acceptable is using past paper questions or the practical guidance booklet diagrams for candidates to do their calculations as this turns the practical into a paper exercise rather than the hands-on use of the apparatus.

Osmosis:

Both osmosis practicals, as expected, were very common and also well presented by the candidates bar some issues with graph drawing (especially lines of best fit!). The moderation team would like to see more biology being presented in the conclusion to the findings from the experiment. There is still some confusion in centres regarding incipient plasmolysis and determination of water potential using the isotonic point found using the weighing method. The isotonic point is not the point of incipient plasmolysis and the pressure potential is not necessarily zero.

Root tip squash:

This was another practical not commonly submitted. There are many different techniques and a good understanding of one of these methods was necessary for the practical examination. Whilst it is difficult to obtain clear cells undergoing mitosis it is important the stages being drawn are correctly labelled. Some centres supplemented their drawings with the use of photos taken down the microscope lens.

It is not acceptable to draw cells from generic diagrams from books or the internet.

Heart dissection:

There were some excellent examples of heart dissection with some centres using cocktail sticks as little flags to label the main parts of the dissected heart. This was then photographed. It is important there is a labelled drawing of the external view of the heart and also a labelled drawing or photo of the internal view.

It is not acceptable to use downloaded images of dissected hearts which are then labelled. Carrying out the actual dissection is the practical skill being assessed not just labelling a diagram (which could be assessed during the practical examination).

Block diagrams:

The drawing of block diagrams (and marking of them) should be linked to the standards expected from an exam question. Only the layers of the tissue should be represented and not individual cells. These should be labelled and if an obvious layer is not labelled this should be penalised. It would aid the moderation team if the centre could include a copy of the photo being used for the block diagram.

Like all biological drawings (also in root tip squash and heart dissection) lines should be solid and not sketchy and should be in pencil.

Sampling techniques:

There were some pleasing ecological investigations presented including rocky shore transects and calculations of Simpson's Index using data from hedgerows and collection of water invertebrates from streams. It is important that when collecting data there is an abiotic or biotic factor linked to the investigation. Simply counting the number of daisies on a lawn is too basic and barely beyond Key stage 3 and not sufficient for AS level. If estimating plant distribution, there should possibly be another site to compare with and some attempt to link the distribution with an abiotic/biotic factor.

Evidence for this should include the tables of raw data collected along with a suitable graphical presentation. (In the case of Simpson's Index the calculation should be also given.)

The moderation team looked closely at the samples with the view that the evidence presented was what was requested in the practical guidance booklet and also it clearly indicated the pupils had actually carried out the practical task. The evidence requested is the minimum to satisfy the requirements, however, the moderation team would suggest that time is spent on fully interpreting and evaluating each practical task as this would prepare pupils for the practical paper.

Contact details

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