Rewarding Learning

CCEA GCE - Biology
(Summer Series) 2011

Chief Examiner's and Principal Moderator's Report

biology

Foreword

This booklet contains the Chief Examiner's/Principal Moderator Report for CCEA's General Certificate of Education (GCE) in Biology from the Summer Series 2011.

CCEA's examining teams produce these detailed reports outlining the performance of candidates in all aspects of the qualification in this series. These reports allow the examining team an opportunity to promote best practice and offer helpful hints whilst also presenting a forum to highlight any areas for improvement.

CCEA hopes that the Chief Examiner/Principal Moderator Reports will be viewed as a helpful and constructive medium to further support teachers and the learning process.

This report 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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Subject Code 1010
QAN 500/2501/6
QAN 500/2503/X

GCE BIOLOGY

Chief Examiner's Report

The examination papers in summer 2011 provided evidence of the high-quality learning and teaching taking place in centres taking CCEA 'A' level Biology. Reports on individual papers will comment in detail on issues relating to each paper but it is worthwhile commenting on some common features at this point in an attempt to encourage centres and candidates to further improve on the high standard set.

Candidates, in general, attempt all the questions; there was very little evidence of questions, or question parts, not being attempted. However, the quality of answers relating to practical work is often disappointing; a comment that applies to all aspects of practical work including both interpreting and planning practical procedures. Additionally, many candidates lose marks through not answering the question as it is asked. Many questions, including those involving content familiar to the candidate, are applied in nature and therefore a suitably tailored response is invariably required.

This year, in both A2 papers, an 'extra lined page', was introduced at the end of the question paper. This was to provide candidates with extra answer space without needing to resort to a supplementary answer booklet. This 'extra lined page' will be added to all papers from January 2012. Candidates should be encouraged to use this space where necessary; they should also be encouraged to make reference to the fact that they have used additional space at the end of the question parts concerned. It should also be noted that many questions now are given extra answer lines and therefore it is not anticipated that there will be widespread need to make use of the 'extra lined page'.

Assessment Unit AS 1 Molecules and Cells

This paper generated an extremely wide range of marks in the candidature and was successful in discriminating among candidates of different abilities. The paper enabled candidates to show the breadth and depth of their knowledge across the unit content. Some of the questions were more challenging than others, assessing more difficult concepts or the application of understanding.

Many candidates performed well, exhibiting a high level of ability and a thorough preparation for the examination. However, centres should be aware that questions involving practical skills appear to be less well answered since the removal of the practical skills paper that existed in the old specification – in this paper it was particularly evident in Q3 and 8. Considering that so many centres do an osmosis experiment as coursework (in which the majority of candidates achieve very high marks), the answers to Q8(c) raise concern. In calculation questions, many candidates continue to lose marks by incorrect rounding up/down and by not using an appropriate number of decimal places or significant figures.

It is also worth noting that there has been a continued decline in the ability of many candidates to express themselves clearly. While this may be penalised within QWC in section B, some ideas were so poorly expressed in section A that marks could not be awarded, for example in Q5(b)(ii). In cases like this it is often appropriate to elaborate the answer with a suitable labelled diagram. Many candidates, including some of the more able, had trouble with spelling and the appropriate use of scientific terms (for example, in Q4).

Yet again many candidates penalise themselves, by not reading the question stem sufficiently well, and so do not answer the question that is asked or by failing to note all the information in the question (for example in Q2 the presence of two lines would suggest that a one word answer is insufficient).

Section A

Q1 This question on meiosis produced very mixed responses, with a large number of candidates scoring no marks because they failed to include reference to stage I or II, even though they identified prophase, anaphase or telophase. Of those who did include the stage I or II, many identified telophase incorrectly as cytokinesis and many others thought it impossible to have 'prophase I' twice and so incorrectly stated that one of the answers was 'prophase II'.

Q2 This question on fungal cell structure was generally poorly answered because candidates only gave one organelle per bullet, despite the fact that for the first bullet there were two lines for the answer. The question also asked 'which **structures** --- **are**'.

Q3 This question, which tested the candidates' knowledge of identification tests for carbohydrates, was well answered by many. The most common error was to mix up maltose and sucrose. A significant number of candidates gave answers that were not in the list given in the question.

Q4 This micrograph of the ileum provided very good discrimination across the ability range. In part (a) a significant number of candidates were able to identify A – D but too many identified E as a villus, rather than the mucosa. In part (b) only a few candidates could give a reasonable suggestion for F. In part (c) it was surprising how few candidates knew the role of the lacteal.

Q5 This question on DNA structure and replication proved to be very discriminating. The majority of candidates could identify the nucleotide in part (a). However, only the most able showed understanding of the classic Meselsöhn-Stahl experiment in part (b)(i). Poor expression in (b)(ii) cost many candidates marks, as too many simply referred to 'half heavy and half light'. A relatively small number enhanced their answer with a diagram, which explained what they meant by 'half heavy and half light'. However, such diagrams are more useful if they are labelled.

Q6 This question concerning enzyme immobilisation discriminated well across the whole ability range. In part (a) lack of precision, such as confusion between absorption and adsorption, cost many candidates marks. While part (b)(i) was generally well done it is evident that calculations and reading values from graphs still prove a problem for many. While many candidates could explain the reduction in activity due to immobilisation (part (b)(ii)), poor expression meant that many failed to explain one other difference (part (b)(iii)), with a surprising number referring generally to increased thermostability (when the question was about the effect of pH).

Q7 Parts (a) and (b) of this question, concerning active transport and diffusion, were generally well answered. However, in part (a) some candidates showed that they still do not understand the term 'trend' and lost marks by simply quoting figures. Others failed to gain maximum marks by only considering horizontal comparisons between living and cyanide-treated cells, rather than also looking at

the vertical trends between the two sugars. In part (b) some candidates lost marks by giving vague references to 'energy', rather than ATP, or by describing why glucose was affected by cyanide, rather than why arabinose was not affected by the cyanide. In part (c) most candidates could identify glycogen and there were many excellent answers concerning its synthesis. However, many failed to gain maximum marks by not being specific enough (for example, by not identifying 'alpha-glucose' or by vague references to branching). A significant minority identified the compound as 'starch' while others described its role, rather than its synthesis. Part (d) concerning inhibitors, was generally well known.

Q8 This was a most discriminating question, with only a small number of able candidates scoring highly.

Part (a) was generally well done although lack of precision, re 'pure' water, caused some candidates to lose a mark. In part (b) most candidates could calculate the water potential and plot the points. However, many lost a mark, as they did not follow the instruction to 'draw an appropriate line of best fit' (many joined point to point, while others drew a straight line between the first and last point, which did not give an appropriate distribution of plotted points on either side of the line). In sub-part (iii) a significant minority determined the solute potential at plasmolysis instead of at 'full turgor'.

Answers in part (c) were extremely disappointing, especially considering that so many centres do this experiment as coursework. In sub-part (i) the vast majority could not describe the procedure that they would have done with potatoes in class (probably on several occasions). A significant number had not linked the introductory statement to the question and so focused on how one would actually use a balance or described how to weigh paper, paper & tissue, and then to subtract paper mass to obtain tissue mass. In sub-part (ii) there were many vague references to 'plot a graph', with no idea of what should actually be plotted. Several candidates indicated a lack of understanding by suggesting plotting a graph with inverted axes i.e. molarity on the y-axis and change in mass on the x-axis. Only a minority could explain the biological basis for this procedure.

Section B

Q9 This prose question required candidates to describe the structure of proteins and their role in the cell membrane. It also proved very discriminating, with a wide spread of marks. There were some very high calibre answers, although only a minority achieved full marks.

In the first section, concerning protein structure, the majority of candidates showed good understanding of the topic and ability to sequence their points appropriately. However a significant minority lost marks by vague answers (for example by simply stating that 'the primary structure involves amino acids joined together' rather than including reference to 'sequence of amino acid' and 'peptide bonds'). There was also some difficulty in differentiating between quaternary structure and conjugated proteins.

In the second section many candidates started with a detailed description of where proteins existed in the bilayer, which did not relate to their role. Again vague points also lost marks for some candidates – for example, many did not

distinguish between channel proteins and carrier proteins that change shape or between facilitated diffusion and active transport.

Quality of written communication was often good, with many well-sequenced accounts that incorporated sound biological terminology. However, it is an area where standards would seem to be slipping, and many candidates lost marks due to poor sequencing or by inclusion of random irrelevant points. Perhaps more emphasis on doing a brief 'essay-plan' would help in this area.

Assessment Unit AS 2 Organisms and Biodiversity

This was a well balanced paper that covered all of the assessment objectives. Candidates were required to recall biological knowledge and to apply their knowledge and understanding in the analysis and evaluation of a variety of stimulus material, including an ecological survey (Q2), a photograph (Q3), graphs (Q5, Q7) and comprehension (Q6). Candidates were also tested in a variety of other skills including drawing (Q3), calculation (Q4) and the ability to communicate biological knowledge and principles by selecting, organising and logically sequencing information in continuous prose (Q8).

This paper was therefore demanding of candidates. The questions were written and structured in such a way that allowed discrimination between candidates of differing abilities. This was reflected in a full range of scores in this 75 mark paper.

Section A

Q1 This question concerning facilitation of gas exchange in the mammalian lung was well answered by the vast majority of candidates. A comprehensive knowledge of this topic area was shown by many candidates who were able to provide not only the relevant features but also describe why they are advantageous. The most common error involved candidates describing **ventilation** rather than describing how **gas exchange** is facilitated.

Q2 **(a)** While the majority of candidates were able to determine that each small square in the quadrat shown represented 4% cover, some candidates were then unable to accurately estimate the total number of squares covered by bladderwrack. Candidates often simply counted the number of squares in which bladderwrack was **found** (17) rather than totalling the number of squares **covered** (9).

(b) A number of candidates referred to random quadrat sampling of the shore. This would be appropriate where there was uniformity in the area being sampled. However, this method is inappropriate in this instance as there is a definite ecological gradient from the upper to lower shore. Consequently a transect is the appropriate method. Most candidates opted for a belt transect. This is most appropriate as it facilitates estimation of the relative abundance of each of the algal species as well as revealing their distribution along the ecological gradient. Some candidates opted for a line transect which reveals distribution of the seaweed species but does not reveal their relative abundance and is therefore of limited value. Fewer candidates were familiar with an appropriate quadrat sampling interval, with one candidate suggesting intervals of 100 metres! Few candidates referred to how the data collected could be presented to facilitate evaluation (kite diagrams/series of histograms).

Q3 This question was again discriminating. While most candidates made a reasonable attempt to draw a block diagram to show the tissue layers in the actual photograph, some candidates still subscribe to the 'cubist' interpretation or some other more abstract artistic interpretation. Some candidates still insist on drawing numerous cells and because of the enormity of this task and the time required to complete it, the quality of their drawing suffered. Most drawings were accurate representations of the photograph and proportionality was generally good. Common errors were tissue layers not shown, e.g. the endodermis represented as a single line and no phloem region identified between the arms of the xylem triarch. Many candidates were able to label the cortex/parenchyma, while a few identified the pericycle, cambium, Casparian strip or distinguished protoxylem/metaxylem.

Q4

(a) This was well answered by the vast majority of candidates who clearly understood that the thick waxy cuticle in the Holm oak reduces water loss by transpiration and therefore is an adaptation to a warm, arid climate.

(b) Many candidates were able to correctly calculate the Simpson's Diversity Index (D) for the holm oak. Most candidates correctly stated the value for the denominator (N(N-1)) as 897(896). However, the most common error was in computation of the numerator ($\sum n_i(n_i-1)$), where candidates often calculated $n_i(n_i-1)$ for each species of moth but then did not sum ($\sum$) these values.

(c) This was well answered with 'protection from predators' the most common correct answer. A few candidates considered that the eggs of the leaf-mining moth were protected from predation by the herbivorous Lackey moth larvae!

(d) Answers here were commonly 'Yew' (correct) or 'Sessile oak' (incorrect). This simply reflected whether or not the candidate understood how to interpret the 0 (most diverse) to 1 (least diverse) scale for the Simpson's Index (D). Confusion may have arisen for some candidates who in part (b), in addition to calculating Simpson's Index (D), **also** calculated the Index of Diversity (1-D) where of course the interpretation of the 0-1 scale is reversed.

(e) Most candidates correctly chose the Sessile oak (and Birch) as the tree species that should be planted to increase biodiversity. However, fewer candidates were able to explain their reasoning beyond quoting from the table in part (d) that Sessile oak (and Birch) had the greatest number of insect species associated with them. Stronger candidates were able to suggest that this range of insect species would, in turn, support many other animals e.g. bird predators and thereby increase biodiversity.

Q5 As always this question concerning O_2-dissociation curves was discriminating. There is evidence that some candidates confuse the two terms – 'percentage saturation' (of the haemoglobin with oxygen) and 'partial pressure' (the level of oxygen in the surroundings).

(a) Most candidates correctly chose the elephant as the mammal with the highest affinity for O_2, from the information presented in the graph. Some candidates incorrectly considered that this was due to the 100% saturation of the elephant's haemoglobin with O_2. The higher affinity was illustrated in the graph by the fact that the elephant's haemoglobin had

the highest saturation with O_2 at any one ppO_2 compared to the haemoglobin of the dog or mouse. In addition the elephant's haemoglobin only showed significant unloading of its O_2 at lower ppO_2 compared to the haemoglobin of the dog or mouse. It was not sufficient to simply state that the dissociation curve for the elephant was 'furthest to the left'; further explanation was required to show full understanding of 'greater affinity' here.

(b) The majority of candidates understood that the haemoglobin of the mouse dissociated its O_2 at higher ppO_2/more readily released its O_2. Fewer candidates, however, linked this to the higher O_2 demand/higher rate of respiration in an animal that has a higher metabolic rate. Too many candidates simply stated 'lower affinity of haemoglobin for O_2' in the mouse (regarding the first mark) and then 'because of higher metabolic rate' (regarding the second mark) without explaining what they understood by these terms.

(c) In sub-part (i) the majority of candidates correctly placed their sketch of the O_2-dissociaiton curve for the dog at higher $ppCO_2$ to the right of that shown in the graph in the stem of the question. In sub-part (ii) most candidates correctly explained that this Bohr effect (shift) would occur when the dog was exercising. Some candidates incorrectly considered that this effect would occur at high altitude! In sub-part (iii) only some of the candidates who correctly identified the Bohr effect in sub-part (ii) were then able to communicate the physiological advantage of this effect in sub-part (iii), which was therefore most discriminating.

Q6 **(a)** Basically candidates either knew the names of the missing taxonomic hierarchical groups or didn't. Spelling of these names was too often poor.

(b) This was generally well answered. Most candidates explained the lethality of rodenticides to the barn owl as a result of lack of food (rodents). Few candidates explained the lethality as a result of toxicity in the owl from bio-accumulation of the persistent (non-biodegradable) rodenticide. Some candidates thought that the rodenticide was an 'infection'!

(c)-(d) These questions were generally well answered by the vast majority of candidates. There was a sound understanding of the strategies/schemes that would result in an increase in the numbers of barn owls.

(e) This question was more discriminating. Only the stronger candidates were able to explain the advantage of genetic diversity in the barn owl population. Genetic diversity allows the **species** to adapt to environmental change. This would involve **some** individuals only in populations of barn owls possessing characteristics enabling them to survive the environmental change. More of these individuals would survive to reproduce, pass on their adaptive alleles via their gametes and thereby leave proportionally more offspring. Thus the importance of genetic diversity is to allow evolution by natural selection of the best adapted individuals.

Q7 This was a discriminating question.

(a) Only the stronger candidates were able to correctly identify a pulmonary artery in the diagram of the heart, and that the aorta is the blood vessel from which the coronary arteries arise. Weaker candidates commonly

suggested the pulmonary vein or even a heart chamber as the origin of the coronary arteries.

(b) **(i)** Few candidates were able to describe the correct sequence of events that result in development of an atheroma. Only a few candidates were aware that the process starts as a result of damage to the endothelium of the coronary arteries. The majority of candidates gave superficial answers involving cholesterol 'sticking to'/'accumulating in' the coronary arteries. Few candidates were aware of macrophages entering the **wall** of the coronary artery in the damaged region(s) and that cholesterol accumulates **in the wall** at the damaged region. Some candidates were aware of Ca^{2+}/fibrous tissue building up in the wall forming a plaque. Some candidates clearly were not familiar with the term 'atheroma'. Consequently their answers outlined the sequence of events involved in blood clotting rather than those involved in atheroma development.

(b) **(ii)** This question was generally well answered.

(c) **(i)** This question was well answered.

(ii) Many candidates struggled to communicate clearly the effect of adding heparin to samples of blood as illustrated in the graph provided. Too many candidates described a directly proportional relationship when the effect illustrated was clearly exponential. Some candidates misinterpreted the relationship shown in the graph and actually concluded that heparin helped the blood clot faster.

(iii) This question was generally well answered.

Section B

Q8 This was a relatively straightforward question concerning the processes involved in the movement of water through a plant. The majority of candidates scored well in their prose account. A few points to note:

- A surprising number of candidates still refer to water moving into root hair cells down a **concentration** gradient i.e. from higher to lower **concentration** of water. Understanding and use of the term 'water potential' is essential at A/AS level.
- Knowledge of apoplast and symplast pathways was generally good.
- Most candidates knew about the role of the Casparian strip as a 'apoplastic block' but often failed to mention where the Casparian strip is found (endodermis).
- Only a minority of candidates explained how root pressure develops.
- Cohesion and adhesion was well explained by the vast majority of candidates.
- The development of a negative pressure (tension) in the leaf was not well understood by the majority of candidates.

- There was much confusion concerning 'evaporation' and 'transpiration' in the leaf.

The quality of written communication was often good: accounts were more concise and well sequenced than has hitherto been the case; while biological terminology was often correctly and appropriately used (though see comments above).

Principal Moderator's Report

Assessment Unit AS 3 Assessment of Practical Skills in Biology

Coursework submitted by most centres continues to be of a high standard with most practicals undertaken coming from a narrow range of topics. The determination and comparison of water potentials of storage organs, enzyme reactions and membrane permeability appear most often at AS level. Teacher annotation was often excellent and it greatly aids moderation when it is clear where marks have been deducted or awarded. However, there are still many centres that do not follow the CCEA guidelines with regard to the submitting of coursework. The samples should be placed in rank order and the candidate record sheets placed in order of candidate number. It is also essential that the Candidate Record Sheets are signed by both teacher and pupil in order to authenticate the work.

Many centres use a template and provided it is appropriate it can be of potential benefit to the candidate and for marking purposes. The template should not be too directive, i.e. giving questions to be answered directly by the candidate, and it should not restrict the candidate's response. In many centres candidates' responses were very similar in their construction and content and were very similar to the centre based mark schemes. It is essential that all work is carried out under correct supervision and that each candidate's work be authenticated as their own.

While most centres have utilised the two mark system appropriately there are still too many centres not using the system in line with the quality of response given by the candidates. For next year (2012) it is important that any significant errors are penalised a mark and those which are irrelevant or have too many errors are penalised two marks. Zero marks are also to be awarded for a non attempt at a skill area.

Implementing

Candidates follow a procedure given by the teacher with preferably a hypothesis being given, and it is important that each candidate or group carries out the whole range of the independent variable.

Recording and Communicating

Again this area shows a large discrepancy between moderator and teacher. There remains an issue with captions (both tabular and graphical) and drawing of lines of best fit. The caption should be **concise** and contain the independent variable (IV), biological material and the dependent variable (DV). If an average/mean is plotted then it should be noted. Lines of best fit where appropriate should be plotted, i.e. for interpolation or extrapolation.

Interpretation

It is important that the task chosen allows the pupil to discuss the outcome in the investigation in enough depth to satisfy the criteria to AS standard. The explanation of the trend should be commensurate with what would be expected in an AS exam. The effect of a changing concentration should at least be measured by a rate of reaction calculation and a description of saturation point necessary to distinguish it from GCSE level.

Evaluation of the Design

This section again showed a large degree of difference between centre marking and moderator's expectancy. The implications of the appropriateness of the measurement should be fully discussed for two marks and the essential controlled variables listed. Candidates should quote/illustrate with examples the degree of variation of the values recorded and not simple calculate a range (this can falsely give a view of variation) and highlight the degree of reliability. This should then be commented on with regards to causes of the variation or the need for replication. This can tie in with validity issues. There are concerns with the understanding of validity by both candidates and what teachers portray to the candidates. For CCEA coursework it is essential candidates can recognise if all variables are controlled or if there are issues with the implementation (in most biology practicals there invariably are issues) which would affect the validity and discuss how this may do so. A simple statement that 'all variables were controlled therefore it is valid' or 'we got the results we expected therefore it is valid' is not enough for a mark.

Assessment Unit A2

General Comments

It is pleasing to note that the A2 papers in summer 2011 provided evidence of much high quality learning and teaching in 'A' level Biology.

In both A2 papers there was a lot of writing required (as is to be expected in papers worth 90 marks and lasting two hours). Candidates should be reminded of the importance of legible writing.

In both A2 papers it is very apparent that many candidates lost marks through not reading the question properly. Mark schemes inevitable reflect the question as it is asked and will reward marks accordingly. When a question asks the candidate to use the information provided they must use this information in an appropriate manner to access the full range of marks available; this comment is very pertinent when reviewing the quality of candidate responses in a number of questions across the A2 papers.

It is still apparent that many candidates have difficulty with questions involving experimental procedures. Again, this was very apparent in both A2 papers. The level of detail required is in excess of that required at GCSE – it appeared that many candidates are either not aware of this or do not have the required knowledge at their disposal.

The top candidates were distinguished by their ability to use 'A' level terminology comfortably and were secure in their factual knowledge. While the A2 papers contain significant applied material many marks are available for (relatively straightforward)

knowledge and understanding. There is evidence to suggest that many of the middle and lower ability candidates do better in application or data handling questions than in those requiring knowledge and understanding of the specification content.

Synoptic assessment is an element that will always be present in A2 papers. Candidates should be aware that synoptic questions will be invariably set in context of the A2 topics that are being examined in the paper. Furthermore, synoptic questions can involve practical techniques and experimental procedures as well as content.

Assessment Unit A2 1 Physiology and Ecosystems

This was the fourth A21 paper in the new specification with a mean very similar to the paper mean of the previous three papers. Responses were generally good although few candidates scored more than 80 of the 90 available marks; a very small number scored in excess of 85. However, it is pleasing to report that very few candidates scored less than 25 marks with no candidates registering in single figures.

Most candidates attempted all the questions and analysis confirms that all questions provided appropriate discrimination, contributing to the high standard deviation of marks achieved.

Section A

Q1 This question required knowledge of synaptic transmission. In part (a) responses were generally good, but many candidates lost a mark through not identifying accurately the structures necessary for saltatory conduction. Many candidates lost marks in part (b) through relating their answer to the process of nervous transmission in the neurone as opposed to why synaptic transmission is unidirectional. Although well answered in general, only a very small minority of candidates achieved all six marks available in the question.

Q2 A significant majority of candidates were able to identify most of the features labelled on the muscle photomicrograph (part (a)(i)). Part (b) discriminated well with, in general, only the more able candidates having a good understanding of the role of calcium ions in muscle contraction.

Q3 This question on sewage pollution proved to be much more discriminating. A very small minority of candidates scored highly. A disappointing number of candidates failed to obtain the two marks available for the percentage decrease in oxygen content in part (a)(i). The marks were usually lost for incorrect calculations as opposed to incorrect reading of the graph. It is also important that candidates use the appropriate number of significant figures in calculations – answers of 95.3% and 95.29% were awarded full marks but not 95%

In (a)(ii) a significant number of candidates answered the question in the context of algal growth and eutrophication instead of focusing on the decomposition of sewage. This question part was a prime example of candidates not answering the question as it was asked and consequently losing marks in the process. Parts (b) and (c) proved more accessible as many more candidates were able to explain the reasons for the increase in oxygen content downriver and the point with the lowest biodiversity respectively. A very small minority of candidates scored the two marks available for part (d). Only the very able candidates appreciated that indicator species monitor levels of pollution over a period of time. Many candidates seemed to assume that chemical testing involved adding chemicals to

the water and they then focused on the pollution caused by the chemicals themselves.

Q4 This question involved the use of novel ecological terms in classifying plants in their ecological role. This question was well done by a majority of candidates although only a very small minority obtained full marks. Part (a)(i) proved to be accessible as most candidates were able to appreciate that ruderals showed characteristics typical of r-selected species. Parts (b) and (c) requiring knowledge and understanding of pests, pesticides and carrying capacity, were generally well answered although marks were lost through not making reference to the economic role of the pest in (b)(i).

Q5 Q5, which was about the phytochrome system and plant hormones, was generally well done. In part (a) a small minority of candidates did get confused between phytochrome and chlorophyll. Parts (a)(iii) and (iv), requiring the interpretation of data indicating that chrysanthemums are short day plants were well answered although a small number of candidates did confuse P_{660} with P_{730} and had P_{660} breaking down during the night. A significant number of candidates failed to appreciate the importance of the continuous (uninterrupted) period of darkness. Part (b) proved to be more discriminating. In (i) many candidates answered that gibberellin, as opposed to cytokinin, is the hormone responsible for plant growth due to increased cell division. In (ii) a significant number of candidates failed to appreciate that not applying hormone to decapitated shoots was an insufficiently detailed answer in describing a suitable control. The answer required the use of similar agar blocks without having hormones present.

Q6 This question involving succession at a lake edge and aspects of the nitrogen cycle proved to be very discriminating. A significant majority of candidates scored 2 - 6 of the 10 marks available. Part (a) proved once again that many candidates are uncomfortable with defining or explaining key terms. The terms 'succession' and 'climax community' appear straightforward but many candidates lost at least one of the two marks available through not providing detailed enough answers. Part (b) also proved very demanding – many candidates provided generic succession answers without paying sufficient attention to the succession trends evident in the photograph. Some candidates were also confused by the conceptual differences between the spatial succession evident on the lakeshore and temporal succession in the one place over time. A majority of candidates were able to obtain the mark available for explaining nitrogen fixation (b)(i) but fewer obtained all three marks for (ii). While a majority of candidates had a general understanding of the role of nitrogen cycle in decomposition, a smaller number were able to explain the processes involved with the degree of detail required.

Q7 In general candidates have a solid understanding of immunity as evident in the answers to this question. Part (a)(ii) involved synoptic understanding of protein structure and its suitability for proving the specific structures required in antibodies. This is a typical example of how synoptic assessment using AS will be incorporated into A2 papers. Many candidates lost marks through lack of specific detail in part (b), e.g. candidates were expected to answer that the swine flu contained some antigens in common (or very similar to) those present on other viruses that older people were previously exposed to – terminology such as 'swine flu being similar to an earlier virus or earlier disease' is not accurate enough. Some candidates did not appreciate the significance of the rapid secondary response in the context of the question and therefore lost marks.

Q8 Q8, as with most questions on this paper, proved to be a very effective discriminator – candidate responses provided a normal distribution across the mark range. Aspects of the question were novel and candidates should expect novel scenarios, particularly at A2 level. In (a) many candidates failed to appreciate that the need to improve reliability through a number of measurements, is a reflection of the variability in light levels reaching different parts of the woodland floor through shading effect, as opposed to changing light levels through the seasons.

Part (b) discriminated well with only the most able candidates obtaining all four marks available in (b)(i). Part (c) was very disappointingly answered; only a very small minority of candidates scored more than three of the available five marks. While many candidates could not accurately describe the formula involved, many lost marks through failing to provide the level of detail required for many of the answer points. The mark scheme was reasonably rigorous and tight, as is to be expected for a five mark question testing a very straightforward concept. It is advisable that candidates are made aware of the degree of detail required and understand the importance of responding with sufficient detail at this level.

Section B

Q9 The essay on the kidney was generally well answered. The significant majority of candidates obtained between 10 - 18 of the marks available. Many candidates provided unnecessary detail on the structure of the kidney and on the role of the loop of Henle but generally there was evidence of solid knowledge about this topic in the candidature. Part (b) on osmoregulation was often answered much better than part (a) on the kidney's role in excretion.

Assessment Unit A2 2 Biochemistry, Genetics and Evolutionary Trends

This was only the second paper in the new specification assessing this unit. Most major topics in the unit were tested in this paper. The paper contained an appropriate balance of familiar and unfamiliar content with a range of skills being tested. Candidates can expect to find question(s) covering statistics in this paper – in this paper statistics was linked to the genetics question – and other 'process' type questions as exemplified by the genetics question.

As highlighted in the introductory comments in the A2 report, candidates can expect elements of synoptic assessment (in the A2 2 paper this can involve A2 1, in addition to AS content).

There was a large standard deviation in candidature performance and the paper provided very obvious discrimination across the candidate range. A significant number of candidates scored in excess of 80 marks and a very small number of very able candidates obtained more than 85 of the 90 available marks – an exceptional performance in a demanding paper.

Analysis of candidature performance revealed that even very good candidates still find some of the statistics difficult and many candidates still have problems when asked to interpret data or to apply what they know in novel contexts. These are important scientific skills that need to be developed and fine-tuned during the A2 course.

Section A

Q1 This proved to be a relatively straightforward question on body layers in different animal phyla. It was answered well by the vast majority of candidates, although some confused the terms mesoderm and mesogloea. In part (b) the correct terminology (triploblastic/acoelomate) was required in describing the body plan of the phylum Platyhelminthes. Most candidates scored 6 - 7 of the available 7 marks

Q2 In part (a) of this question the precise location of the light independent stage was well known but many candidates were unable to explain why the term 'light-independent' is more appropriate than 'dark stage'.

Part (iii) was discriminating and produced the full range of marks - a minority of candidates explained the change in glycerate phosphate instead of triose phosphate. In part (b) many candidates confused the action spectrum with the absorption spectrum.

Part (c) proved (perhaps surprisingly) to be a very challenging question and relatively few candidates were able to plan, in outline, an experiment to investigate the effects of red and blue light on the rate of photosynthesis in a water plant. The use of filters to produce light of different colours was not well understood. In addition, there were very many vague answers; it was common to see answers referring to measuring the 'amount' of gas produced. While many candidates understood that light intensity and temperature are variables that need controlled in this type of the experiment (standard GCSE understanding) they failed to explain how they would control these variables. A significant number of candidates based their answers on potometers or respirometers. The very poor quality of answers in part (c) contributed significantly to the modal mark in this question being less than half the available marks for the question.

Q3 This question was generally well answered, although some of the descriptions of how ATP is produced in the ETC were a little vague. Knowledge of this topic across the candidature appears strong but only the most able candidates were secure enough in their knowledge to avoid at least one inaccuracy appearing. In part (b) only a small minority of candidates were able to explain that the RQ value of 1.24 for CHO suggests both aerobic and anaerobic respiration.

Q4 In part (a) the vast majority of candidates were able to identify the tRNA molecule but many then went on to give a general description of translation that did not make sufficient reference to the information available in the diagram. Responses to part (b) highlight the importance of candidates answering the question as it is asked in the paper. General references to tRNA bringing another amino acid to the appropriate codon on the mRNA may demonstrate correct understanding but does not answer the question.

Candidates were expected to use the diagram to show that it was a particular amino acid (Ser) that would be next to link to the mRNA. In part (c) the best answers explained the term 'degenerate' by referring specifically to the two codons UUC and UUU which are seen in the diagram to code for Phenylalanine (Phe).

Part (d) produced the full range of marks with the best answers linking mutation to the changes in the base sequence and then to the changes in the specific amino acids in the polypeptide chain coded for by the DNA. Some marks were

carelessly lost through candidates stating that all the amino acids in the protein are affected in a frameshift mutation rather than all the amino acids after the site of the mutation. This lack of attention to detail was one of the key factors that differentiated between many of the very able candidates and those candidates who had a good general understanding but lacked the fine detail.

Q5 This genetics question proved to be a difficult question for many and produced the full range of marks. In part (a) most candidates were able to state the parental genotypes/gametes and complete the genetic cross but relatively few identified metaphase 1 as the phase of meiosis during which independent assortment occurs.

In part (b) many candidates were able to suggest a null hypothesis and calculate a value for Chi squared but very few were able to answer parts (b)(iii) and (iv) correctly, with the value for the probability causing problems for many. The distinction between 'the decision about the null hypothesis' and 'explaining the outcome of your statistical test' was only well understood by the most able candidates. In part (c) only the more able candidates were able to use the Hardy-Weinberg equation correctly and state a condition met by the *Drosophila* population in this question which justified its use – again there were many generic answers to part (c)(ii) relating to assumptions that must be made when using the Hardy-Weinberg equation.

Q6 This question started with what should have been a relatively straightforward genetics pedigree but many candidates were unable to explain the genetic basis of Paul's CF and many mistakenly thought it was a sex-linked trait. Many other candidates did understand that Paul's parents must be heterozygous but only a small minority explained the position of the grandparents accurately – a common answer was 'two of the grandparents must be heterozygous'; this answer failed to get the appropriate mark as it is not just any two of the grandparents, but at least one from 'each side of the family' that must carry the affected allele.

In (a)(ii) the best answers referred specifically to the limitations of the use of gene therapy in the treatment of cystic fibrosis and used some of the clues available in the introduction to the question. Part (b) was generally well answered, but in (c) the definitions of 'genome' were too vague and too often referred to the genes or total genetic makeup. The term 'designer drug' was not that well understood.

Q7 This was a difficult question which proved to be discriminating and also revealed that many candidates still find it difficult to interpret graphs and to apply what they know in novel contexts. In part (a)(i) the best answers very concisely linked increasing soil nitrate levels to leaf length or width and explained the relationship accordingly.

In (a)(ii) only the more able candidates used the values for the experimental garden appropriately to demonstrate that the difference in leaf width between the two sites has a genetic basis. Only the very best candidates scored well in part (b)(i) which required evolutionary theory to be applied specifically to the evolution of wild garlic. A surprisingly large number of candidates linked the leaf width to light levels as opposed to nitrate levels. More candidates were able to suggest that crossing garlic plants from the two sites would allow a determination as to whether a new species had evolved.

Section B

Q8 In part (a) it was evident that many candidates had only a very superficial or a rather confused understanding of the life cycle of flowering plants. The formation of the mega- and microspores and development of the male and female gametophytes was not well understood and there were relatively few accurate, logically sequenced and sufficiently detailed accounts that received high marks. Part (b) asked the candidates to consider how mosses, ferns and flowering plants are adapted for life on land. This was much better understood and many candidates scored well and provided high quality answers. The quality of written communication was generally quite good although in some cases the standard of handwriting was very poor and occasionally answers were virtually illegible.

Principal Moderator's Report

Assessment Unit A2 3 Assessment of Investigational and Practical Skills in Biology

Work continues to be of a high standard and the majority of investigations chosen fully allow candidates to access all of the marking criteria. However, care should be taken when approaching a topic which is not specific to the specification as this can often lead to problems with the amount of guidance given to candidates and therefore can limit differentiation.

A1 Develop a Hypothesis

The main problem which arose this year is the amount of irrelevant biological background and a slowness to get to the point of the investigation. This greatly impinges on the time which should be spent on the coursework and it shows a limited ability to link the biology to the problem. This in future should be penalised. Hypotheses were often either too limited or too long winded and were in some cases non-directional.

A2 Plan a Procedure

It is imperative that the pupils derive their own range for the independent variable (IV) and their own controlled and dependent variables. In many centres the pupils seemed to choose exactly the same IV and frequently this was an unexpected range or it was the same as the centre based mark scheme. Once pupils have decided **their own suitable range** and method it is then possible to give a standardised plan for all candidates to implement. Plans should not be written in the past tense.

A3 Planning for Analysis

As with above, pupils should choose their own statistical analysis to match the independent variable they have chosen. Again this can be changed to match the common procedure to be used. When choosing the statistic for analysis it is important candidates choose the **most appropriate** method and justify their choice. This was a recurring theme with two marks being awarded without appropriate justification.

B1-B2 Recording and Communicating

Similar to last year there are still some centres assessing a variety of tables and not those constructed by the pupils to record raw data. Many problems in this section are similar to those at AS Level. During implementation of the procedure it is important the candidates show appropriate precision and accuracy in the measuring and recording of the dependent variables. In many cases candidates when addressing validity discuss how they could measure more accurately e.g. reading a measuring cylinder more accurately, so they could be penalised in implementing for not showing the correct degree of accuracy!

C1 Analysis

This is usually very well carried out; however there are still centres awarding two marks for a Null Hypothesis which mentions neither the mean nor significance and many captions are too long and do not contain concisely the correct information.

C2 Interpretation

Candidates are much better at using their statistics to assess the reliability and also the extent of replication. If a set of results are reliable then the candidate should recognise there is no further need to replicate the data (in fact in many cases replication will not lead to more reliability).

The biological knowledge, were appropriate, should not just be a regurgitation of that given in A1 but an attempt to explain specific findings to show a higher level of understanding of the investigation.

C3 Evaluation

As with previous years this area shows the greatest degree of differentiation between candidates and also discrepancies between teacher marking and moderation. Candidates were frequently awarded two marks for simply stating they found what they wanted therefore the range was appropriate when their results often indicated a more narrow range (or widening of the range) would give a more specific outcome to their investigation.

Validity issues were frequent and similar in their problems to those found at AS Level and the mistakes of last year as to outlining an independent variable were again evident. The candidate should choose another IV which they feel could affect the investigation and then give a brief outline as to how they would investigate it and what they might hope to find.

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