Rewarding Learning

GCE BIOLOGY
(Summer Series) 2010

Chief Examiner's and Principal Moderator's Report

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Grade Boundaries

Grade	Uniform Mark
AS Maximum Mark is 300	
A	240
B	210
C	180
D	150
E	120

Grade	Uniform Mark
A2 Maximum Mark is 600	
A	480
B	420
C	360
D	300
E	240

Chief Examiner's Report

The summer AS papers highlighted specific aspects of this cohort of candidates. Many candidates were well prepared exhibiting a high level of ability and a thorough preparation for the examination. They were able to show the breadth and depth of their knowledge across the AS content. However, questions in some areas were inconsistently answered. For example, there were many outstanding answers within Section B of AS1 – 'Factors influencing enzyme activity'. In the same paper, many candidates did not appear to understand the related topic of how to use a colorimeter.

Question parts testing practical work and skills, are an integral part of both AS papers. In AS2 the use of hydrogen carbonate indicator to detect changes in the concentration of atmospheric carbon dioxide was well understood and the concept of the light compensation point was succinctly explained by most candidates. However, in AS1 many candidates had a limited knowledge of colorimetry despite this being specified in 1.2.4 *use of a colorimeter to follow the course of a starch – amylase catalysed reaction (or other appropriate reaction)*. There was little understanding of the 50% plasmolysis method of determining solute potential, or of why onion and *Elodea* have different solute potentials.

In both papers, candidates were asked to carry out tasks associated with data presentation. In AS2, candidates were asked to organise raw data into the form of a table. Most tables were well constructed. In AS1 data was presented in a graph. Again these were generally well plotted. Captions were occasionally omitted and when attempted, some were not sufficient for a stand alone table or graph. The drawing of a block diagram is an alternative to these questions. The production of a dichotomous key would be another alternative skill.

Questions with the prompt 'suggest' requires any reasonable explanation of the information. There is often not a single correct answer. The questions are intended to assess a candidate's ability to apply biological knowledge and processes to unfamiliar situations. This prompt is used infrequently in AS papers. Examples include the following:

- AS1 Q6(c)(ii) – explanation for trends in a graph;
- AS1 Q7(c)(iii) – one reason for the difference in the solute potentials of onion and *Elodea* cells;
- AS2 Q5(b) – reasons for changes in pulse rates;

- AS2 Q7(b)(ii) – reasons for differences in xylem lignification;
- AS2 Q8(b) – relationship between insects trapped and success of rearing skylark chicks; and
- AS2 Q8(c)(iii) – how values of Simpson's Index may change.

The ability of many candidates to express themselves clearly has declined. The standard of written communication in some of the answers in Section A questions made it difficult to determine what the candidates were trying to communicate. In Section B 'Quality of Written Communication' is awarded a maximum of two marks. However, some candidates are losing more marks in Section A as a direct result of poor communication.

The rest of this report details the response to each assessment unit, and the individual questions in each paper.

ASSESSMENT UNIT AS 1 MOLECULES AND CELLS

This paper generated a 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 of a general area of weakness – candidates' lack of ability when dealing with questions or question parts testing practical work and practical skills. It is also worth noting that there has been a 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. Even some of the more able candidates had trouble with spelling (for example, 'siccossers' for scissors and 'glyclaix' for glycocalyx), and the appropriate use of scientific terms. It must also again be reported that some candidates penalise themselves by not reading the question stem sufficiently well and so are not answering the question asked. This was most obvious in Q5, part (b). On the plus side it is pleasing to report that, in general, candidates understanding of topics within this unit was good and this was especially illustrated by the many excellent answers within Section B.

SECTION A

Q1 This question on membrane structure and function was very well answered. Most candidates scored full marks.

Q2 This question on mitosis was a little more challenging, and most candidates showed a thorough understanding of the topic. However, there were a considerable number of candidates who failed to present two correct pieces of evidence in part (d). The most common failings were in reading the question carefully enough, and in presenting 'evidence from the diagrams' given in the question-stem. Thus references to 'genetically identical' or 'ploidy' were incorrect.

Q3 This question tested the candidates' knowledge of the adaptations of a leaf for maximising photosynthesis, while minimising transpiration. It was discriminating. Some answers were very good, demonstrating thorough knowledge of the structure and function of the leaf. However, many candidates failed to relate the adaptation to its specific location and function, and confused whether the adaptation was related to photosynthesis or transpiration.

Furthermore, some candidates did not employ good examination technique and in the part on photosynthesis they failed to present three specific adaptations when it was evident that three marks were available.

Q4 Aspects of a liver cell were tested in this question, with a range of skills and understanding being assessed. This proved to be particularly discriminating.

In part (a), very few candidates were able to identify (C) as euchromatin, most offering nucleoplasm as the answer. Most candidates made a good attempt at the calculation of magnification in part (b) - the most common mistakes involved the conversion from mm to µm or measuring the whole photograph rather than the scale bar. Part (c), on the other location of glycogen in the body, was well known. Part (d) was well answered where the candidates understood the branched nature of glycogen (some candidates referred only to coiling which was not sufficient); few candidates mentioned the insolubility of glycogen in relation to storage. Starch was well known as the equivalent storage polysaccharide in plants in part (e) – incorrect answers usually referred to cellulose.

Q5 This question tested the area of DNA technology. Part (a) dealt with the more familiar polymerase chain-reaction and was often well answered, though some in sub-part (iii) considered incorrectly that cooling was to prevent the denaturation of polymerase (heat-tolerant polymerase is used) rather than to allow the primers to anneal to the DNA strands. Part (b) on nucleotide structure was poorly answered: most candidates offered answers describing how polymerase was involved in attaching individual nucleotides to the DNA templates (similar to a question set on a previous AS1 paper); while many of those who understood what they were being asked, did not give enough detail. For example, they did not identify the pentose sugar as deoxyribose or specify the names of the bases. Part (c), on the action of restriction endonucleases, was not well done: to answer sub-part (i) candidates had to follow the instructions in the stem which many were unable to do; while in sub-part (ii) some correctly identified a 'sticky end', the examiners would have accepted any reference to an uneven or staggered cut. In part (d), on the use of DNA probes, answers were either very good or very poor, reflecting candidates' coverage of the topic.

Q6 This question involved the use of colorimetry in analysing the leakage of pigment from beetroot cells when cylinders of beetroot were treated at different temperatures. It was a most discriminatory question.

In part (a) many candidates did not appear to understand how the colorimeter worked: in sub-part (i) few understood the role of the filter and specifically that a blue filter transmits blue light and that blue light is absorbed by a red solution; sub-part (ii) was better and most candidates successfully suggested one of the many precautions involved in colorimetry; while in sub-part (iii), the procedure was not fully described - for example, only a few referred to the standardisation of the colorimeter by using a blank (water) to set transmission to 100% before taking a reading for a sample, while some considered that light travels through the sample before it reaches the filter or that the filter is needed to 'absorb the pigment' (confusing the terms filter, pigment and light).

In part (b), graphs were generally well plotted. The most common areas where marks were lost were in the failure to devise an appropriate caption and to join points with short straight lines.

In part (c)(i) the decreasing trend in transmission as temperature increased was well identified, but not the constancy of transmission below 50ºC. Explanations frequently related to the leakage of pigment at higher temperatures though only the more able candidates were able to relate this to the cell membrane's loss of integrity.

Q7 This question on plasmolysis of plant cells and the determination of solute potential in two plant species was particularly testing. It was a most discriminatory question.

Nevertheless, part (a) was well done. In sub-part (i), a range of appropriate actions were allowed – most suggested staining the tissue. Sub-part (ii) was most often correctly answered though some considered that the vacuole rather than the whole protoplast, pulled away from the cell wall while some described turgidity.

Part (b) was again frequently well done though some considered that the chloroplasts moved to the centre of the cell to obtain more light for photosynthesis rather than referring to a disappearing vacuole or a shrunken cell.

In part (c) there was little understanding of the 50% plasmolysis method of determining solute potential, or of why onion and *Elodea* have different solute potentials. These are more difficult concepts and only the higher ability candidates were able to attempt this question with any degree of competence. Centres should note that the *determination of the average solute potential from a graph of percentage plasmolysis against solute potential of the immersing solution at 50% plasmolysis where the average pressure potential is zero* as specified in the specification (section 1.6).

Part (d) was generally very well answered though some considered the problem to involve the uptake of salt rather than the loss of water.

SECTION B

Q8 This prose question required candidates to discuss the influence of three factors on enzyme activity, having to first identify the factor involved in each case. Answers were frequently of a very high standard and many candidates scored well. It was most pleasing to note that candidates when asked to describe the trends, did so with reference to the independent variable and enzyme activity, ie as temperature increases so too does enzyme activity, rather than just 'the graph increases' which is much too vague. Understanding of the properties of enzymes was also very well known. However only a few candidates understood the effect of pH on ionic bonding or the charges on the R-groups. In the third section some candidates failed to relate an increase in substrate concentrations to an increase in collisions. The quality of the responses was very impressive and the topic seems to be well understood. The quality of written communication was often good, with well-sequenced accounts that incorporated sound biological terminology. However, it is an area where standards seem to be slipping.

ASSESSMENT UNIT AS 2 ORGANISMS AND BIODIVERSITY

This was a very discriminating paper which allowed candidates of all abilities to express their knowledge of the topics examined. In this paper, candidates were asked to extract and interpret data from a variety of formats. This ranged from interpreting data from prose (Q8), to diagrams (Q6 and Q7), tabular data (Q6 and Q8) and graphical data (Q8). In addition, candidates were asked to use a dichotomous key to help them identify unknown kingdoms. In Q5 candidates were asked to organise raw data into the form of a table; although this was the first time this has been assessed, the standard of tabulation was generally good (candidates should be familiar with this task from their coursework). In Q9 candidates were required to

select and sequence their ideas on Fick's law, its influence on the rate of diffusion and apply their knowledge of this law to adaptations for gas exchange in the mammalian lung.

The overall standard of answering was good, but several problems were commonly evident. Firstly, candidates must read question stems carefully and answer what is asked of them; far too frequently key terms or phrases were ignored. Secondly, candidates must be more precise in how they express their answers; this was particularly evident in Q8 and 9 where it was frequently difficult to award marks due to the ambiguity of the candidate response.

SECTION A

Q1 This was a discriminating question which examined the candidates' ability to use a dichotomous key concomitantly with their knowledge of the five kingdom classification system. Protoctista and prokaryotes were frequently interchanged by candidates while many, unfortunately, used class or phyla names rather than kingdom names as asked for. The overall standard of spelling was generally poor.

Q2 This question on the effect of both herbicides and artificial fertilisers on biodiversity proved to be discriminating. A number of candidates struggled with the term 'herbicide' with others simply stating that 'herbicides kill plants'. Candidate knowledge of artificial fertiliser was generally better with many answers giving detailed accounts of fertiliser damage to soil structure or increased soil acidity. Most candidates opted for leaching leading to eutrophication with consequent damage to aquatic ecosystems. Strangely, a surprising number of candidates indicated that artificial fertilisers reduce soil fertility. Weaker candidates tended to discuss several effects of each agricultural practice without relating them to changes in the biodiversity as requested.

Q3 A generally well answered question on the process of blood clotting and the role of polymorphs at the site of a cut. It must be noted that the spelling in this question was poor. Additionally, many responses were far too vague when describing the role of polymorphs – 'they fight infection' being a frequent answer.

Q4 This question examined candidate knowledge on the role of three features in the major blood vessels and as predicted proved to be very discriminating. The vast majority of candidates knew the role of valves in veins. Most knew that elastic fibres allowed for expansion under pressure in the artery although few understood the concept of elastic recoil and development of a pulse wave. Once again the role of smooth muscle in arteries was poorly understood. One of the most common mistakes was linking the muscle to some sort of peristaltic contraction to help push the arterial blood along. Another relatively common mistake was to focus on the word 'smooth' and link it to reducing the friction which slows the blood flow in the artery.

Q5 In this question candidates were asked to organise raw data into the form of a table and suggest possible explanations for the changes in pulse rate during the investigation studied. On the whole, the tables were well constructed with the most common error being the row/column headings including beats per minute rather than beats per thirty seconds as was in the raw data. Several candidates actually converted the data to beats per minute to allow their headings to be correct. Captions were occasionally omitted and when attempted, some failed to highlight the fact that the two groups came from different athletic abilities. In part (b) many candidates were able to suggest possible reasons for the differences noted in the data for the two groups. Many struggled with the final bullet on why conversion to percentage allowed for comparison between the two groups.

Q6 A generally well answered question on gas exchange in plants and the use of hydrogen carbonate indicator to detect changes in the concentration of atmospheric carbon dioxide. In part (a), most candidates were able to describe three leaf adaptations for carbon dioxide uptake but a minority of candidates answered in relation to light absorption. Parts (b) and (c) were discriminating and this was simply due to the vagueness of their answers. At this level we expect candidates to say more than simply 'control' as an answer for part (c). Parts (d) and (e) were generally well understood, particularly the concept of the light compensation point in part (e). The most common mistakes in these parts were not to link the processes of respiration and photosynthesis and simply answer in relation to one process. Strangely, in part (d), many candidates suggested that there would be no photosynthesis at light intensity one.

Q7 This was the most discriminating question on this paper and examined candidate knowledge of the distribution, structure and function of vascular tissue in the stem of a plant. In part (a)(i) many candidates seemed to ignore or misunderstand the word 'distribution', with their answers relating to the function of both xylem and phloem. Many also missed the word 'stem' and drew or described the distribution within the stele of a root. Part (ii) was generally well answered. Part (b) focused on the role of the xylem, its lignifications patterns and the role of its pits. This was generally poorly answered with many answers not showing any progression from GCSE level.

Q8 This question required candidates to read and interpret information on skylark biology and the farming strategies designed to improve their nesting success. In part (a) candidates were generally successful in determining which of the three strategies would be best at improving breeding success. They were also generally capable of extracting two other relevant trends from the data provided. In part (b) candidates were asked to analyse pit fall trap data and further relate it to skylark breeding success. In most cases candidates were able to link chick rearing success to the greater availability of food but few then linked this to the fields with unsown areas. In part (c) candidates had to compare the unsown strategy to the practice of leaving field margins unplanted. In part (i) only the better-prepared candidates achieved full marks for the percentage increase calculation. It was evident that some candidates could not accept an increase over one hundred percent and recalculated to get a percentage increase below the one hundred percent value. Parts (ii) and (iii) examined knowledge of the methodology and interpretation of the Simpson's index and was generally well answered when attempted. However, the standard of written communication in some of the answers made it difficult to ascertain what the candidates were trying to communicate.

SECTION B

Q9 In this question candidates were asked to explain how the various factors involved in Fick's law could influence the rate of diffusion; and then go on to use their knowledge of these factors to describe how the mammalian lung is adapted to maximise gaseous exchange. In part (a) most candidates were able to explain how each of the factors would influence the rate of diffusion although some candidates, when explaining the role of a concentration gradient, did not discuss the rate of diffusion but rather that a concentration gradient was needed for diffusion to occur.

Part (b) proved to be very discriminating, particularly the first bullet which tested knowledge of surface area. In this part many candidates focused on the gross structure of the lungs as a whole rather than at the microscopic structure of the alveolar gas exchange surface. The second bullet, which tested knowledge of the role a concentration gradient, was usually the best of the three answers with candidates understanding the role of ventilation and a good vascular supply in the maintenance of a steep concentration gradient. It must be noted that a fairly large number of candidates seemed to have no knowledge of the mass flow of air into and out of the lungs, and tried to attribute inhalation and exhalation to diffusion gradients created by gas exchange at the alveolus. In the final bullet, which tested knowledge of diffusion distance, most candidates understood the importance of thin epithelia/endothelia and were able to name them as 'squamous'. Only the better-prepared candidates understood the importance of the close proximity of the blood and the alveolar air in maximising gaseous exchange.

Principal Moderator's Report

ASSESSMENT UNIT AS 3 ASSESSMENT OF PRACTICAL SKILLS IN AS BIOLOGY

The quality of work submitted continues to be of a high standard which reflects in general a good awareness by teachers of the standard required to meet each of the marking criteria. Teacher annotation of work was often excellent with many centres providing appropriate centre based mark schemes. This greatly aids the moderation process. However, many centres still do not follow CCEA requirements regarding administration procedures and submitting of coursework. Coursework samples should be placed in rank order with the remaining candidate record sheets being included in order of candidate number. TAC2 forms should be signed and included and the teachers involved (where applicable) in internal standardisation indicated. All candidate record sheets should be signed by both teacher and candidate.

When preparing candidates for sitting of coursework it is important professionalism is shown with regards to the amount of guidance given both orally and in the form of directed questions to the candidates. In many centres responses given by candidates are very similar across many of the criteria and they bear very close resemblance to the mark schemes provided. It is important that, just like with exams, candidates give their own composed responses to the criteria.

There are still several areas of concern which are common to both AS and A2 coursework which will be discussed in more detail in this report. In general the two mark system is well applied but it is worth clarifying here the overall aim of the new system. Two marks are to be awarded when the candidate deals accurately and correctly with very little error with each criterion. When there is an error in judgement or biology then one mark should be awarded. If there are too many errors/incorrect information, or if an area is not attempted then zero marks should be awarded.

IMPLEMENTING

Candidates should follow a practical procedure given to them by the teacher and, where possible; it would greatly aid the candidate to interpret the results if a hypothesis and a prediction were outlined in the procedure. Candidates are required to carry out the investigation across the range of the independent variable and it is not necessary to calculate any statistics.

RECORDING & COMMUNICATING

This area saw a large number of discrepancies between moderator and teacher marking. "My results", "Table of Results" etc are not suitable for one mark as a caption; this should be awarded zero marks. One mark should be deducted if units are included in the body of the table. Graphs were generally well presented, however, the choice of graph was often unsuitable and there were problems with the choice of line used to represent the results.

INTERPRETATION

The key issue with interpretation is the depth of biological knowledge used. It is essential the knowledge and terminology used is of AS standard and what would be expected when answering exam questions. Changing concentration of substrate or enzyme does not really allow candidates to produce work beyond that which is required for GCSE. Interpretation should allow some differentiation between candidates.

EVALUATION OF THE DESIGN

This was another section which showed differences in the standard expected by the moderation team. More discussion as to the implications of the appropriateness of the measurements taken would be expected for two marks.

When assessing reliability a calculation of the range is not enough for two marks. Indeed a large range value does not necessarily mean a lack of reliability as the other values may be very similar.

As with last year validity is an area not well understood by both candidates and teachers. It is not sufficient to say that the practical procedure was followed carefully therefore the results are valid. With the majority of investigations used and the very nature of working with biological material there are many opportunities for the candidates to discuss various issues which may affect validity.

Chief Examiner's Report

The new specification, page 75, sets out the assessment objective weightings for each assessment unit conforming to those set out in the Science Criteria. The table below shows the weightings.

Assessment Objective		Assessment Unit	
		A2 1 /%	A2 2 /%
AO1	Knowledge and Understanding of Biology and How Biology Works	**35**	**35**
AO2	Application of Knowledge and Understanding of Biology and How Biology Works	**50**	**50**
AO3	How Biology Works	**15**	**15**

The emphasis on application of knowledge and understanding clearly has had implications for both assessment units A2 1 and A2 2. This is exemplified by Q5, A2 2, which is typical of the necessity to provide an unfamiliar context for candidates to analyse and evaluate biology knowledge and processes. Genetically transformed plants were compared with control plants in an investigation of factors limiting photosynthesis. There was no requirement to explain the production of the transformed plants.

There was also an attempt to include some of the question styles and contexts previously found in A2 3A. The use of statistics in planning and analysis of results will only be in A2 2 papers. A passage setting out a variety of points will be another common feature of A2 2. However, synopsis will be limited as there are now no links within the specification to particular sections of other assessment units.

HOW BIOLOGY WORKS

At Key Stage 3 we are familiar with How Science Works and in the future we will become aware of the influence of this objective at Key Stage 4. The new specification, page 74, sets out 12 points which should be integrated with the specification content listed in section 3. Some aspects of these points will be incorporated in questions where appropriate. Questions will be included to assess some aspects of planning an investigation. This may include parts such as (c) within Q5 A2 2. Hypothesis development and planning a procedure may also feature in A2 1 papers, however where this involves planning for statistical analysis this will only be in A2 2.

The response from candidates in the present series in these new circumstances was exceptional. This was especially pleasing in the terminal A2 2 paper where markers repeatedly expressed their pleasure at the excellent responses from candidates.

The rest of this report details the response to each assessment unit and the individual questions in each paper.

ASSESSMENT UNIT A2 1 PHYSIOLOGY AND ECOSYSTEMS

This was the second of the new specification A2 papers. At 2 hours in length and 90 marks being allocated, the paper was quite demanding. Generally, responses were of a good standard though marks above 80 were very few in number. All questions were discriminating and the paper gave all abilities the opportunity to show what they knew, with most candidates able to attempt the majority of each question. A continuing weakness across the middle and lower ability candidature is the inability to produce 'precise, detailed biological answers' and perhaps some of these candidates could have improved their results by spending more time reading questions carefully (including all the information given at the start of a question), thinking about what was required and then writing less (often 'bullet point' answers score highly in Section A). Terms like 'describe' and 'explain' still are confused by too many candidates, as was very evident in Q4. Despite comments in the specification about the detail required in certain topics, some centres are still teaching a lot more detail than necessary – this was particularly evident in Q9. Knowledge of practical techniques still poses a problem for many candidates, although this is often centre-based. There is also evidence that candidates tend to struggle when required to apply their understanding to novel situations, as was obvious in Q2, 4, 7 and 8.

SECTION A

Q1 This question required knowledge of antibody response in the context of the ABO blood grouping system. In part (a) marks were lost by vague answers to the 'precise' location of the antigen (for example 'on the blood cells') and by describing agglutination as 'clotting' rather than 'clumping' of red cells. A significant number of candidates also interpreted the question as an immune response to an introduced pathogen, including much irrelevant information about sensitising of lymphocytes and production of memory cells.

Q2 This question about energy flow in an ecosystem was very discriminating, with only the very best candidates scoring full marks. In part (a)(i) many candidates could not decide which were the relevant figures to use. In part (ii) many did not understand the term 'processes' or answered in terms of energy transfer from sunlight to plant. In part (b) many misinterpreted the question in terms of what happened with energy (or protein) transfer from the silage rather than what happened within the field.

Q3 The context was an experiment on kidney function. Part (a) involved the analysis of experimental results. In part (ii) many could correctly work out which was the more concentrated solution but then could not link this to the term 'low solute potential' (with many thinking that 'more dilute' has a lower solute potential). This suggests an inability to use relevant synoptic knowledge, as water potential is now generally well known at AS level. Osmoregulation was generally well known, although many candidates failed to read the question, and consequently gave a general answer on kidney function, rather than applying their knowledge to the situation of 'after drinking a large volume of water'.

Q4 This question related to crop rotation and the nitrogen cycle. In part (a) many candidates could not identify how root nodules became 'rich in amino acids' but the majority showed good understanding of the role of decomposer and nitrifying bacteria. In part (b)(i) the majority described the trend rather than explaining it as asked. In part (ii) many described two benefits rather than describing and explaining one benefit. A small, but significant, number of candidates described an increase in soil nutrients rather than a different benefit.

Q5 This practically based question on the use of a haemocytometer was very discriminating and parts (a), (b) and (c) posed problems for a majority of candidates. Very few candidates recognised the need to agitate the suspension before sampling or to dilute the suspension before sampling a dense population (the most common answer in part (c) was to describe the 'capture/recapture' technique). While a majority could correctly count the cells a large number of candidates could not convert this 'cells per mm^3'. Most candidates scored highly in part (d).

Q6 This question about the eye was generally well answered. The photograph, with closed eyelids, proved testing for some, but most could recognise at least two structures. A majority of candidates knew the answers to parts (b) and (c) but many failed to get full marks by giving vague or careless answers (for example by simply stating that 'muscles contract' to constrict the pupil or by suggesting that the 'iris constricts'). A significant number of candidates are unclear about the action of the ciliary muscle and suspensory ligaments.

Q7 The majority of candidates showed good knowledge of the role of phytochrome in part (a). In part (b) many could identify what was happening in experiment 2 but lost marks by giving vague answers (for example by referring to 'darkness' rather than the length of the photoperiod experiences by bud or leaves in part (i) and by stating 'as a control' rather than explaining the purpose of a control in part (ii). Part (c) proved very discriminating as many candidates simply repeated the stem of the question.

Q8 This question about the effects of an organic discharge into a river proved to be very discriminating. Those who scored high marks here showed that they had read **all** the information (both in text and diagram) given at the start of the question and various sub-parts. In both parts (a) and (b) many candidates failed to recognise that an increased BOD means a decrease in oxygen available to other organisms. In part (a) many described 'eutrophication' and its consequences rather than picking out that the

slurry included respiring microbes and then considering what happens to them as they travel downstream. While there were many excellent answers to part (b) too many candidates simply repeated the stem of the question rather than explaining how the adaptations would help these organisms and also too many described the changes in aquatic communities rather than explaining them. In part (c)(i) the majority assumed that the nutrients came from leaching or run-off rather than being released by the decomposition of the organic discharge. The majority of candidates could explain the consequences of eutrophication, although there are still many who think that the algae uses up the oxygen.

SECTION B

Q9 This prose account on the generation of an action potential and transmission of an impulse along the axon and across the synapse produced a wide range of marks among the candidature. While there were many excellent and concise responses, many weaker candidates only seemed able to score in the transmission to the post-synaptic membrane. A significant number of candidates gave great detail on the ionic changes that occur during an action potential, despite the fact that the specification is quite clear that this is not required.

Quality of written communication was often good, but there were too many rambling accounts and a significant number failed to use sound biological terminology.

ASSESSMENT UNIT A2 2 BIOCHEMISTRY, GENETICS AND EVOLUTIONARY TRENDS

This was the first paper assessing this wide ranging unit. The content selected for testing reflected most aspects of the unit. Questions requiring knowledge and understanding of the specification content are limited at A2. However, many of the unfamiliar contexts requiring interpretation and evaluation were directly related to the unit content. There were also synoptic elements to some parts of questions. These parts of the questions do not require specific links to other modules as they occur naturally in the elucidation of many of the topics in this unit. This paper is the 'natural home' for statistical analysis as it is the terminal unit. This is one of the skills previously assessed in paper A2 3A.

A two hour paper is demanding and with a large amount of reading in addition to stimulus material in the form of photographs, diagrams, tables and graphs this paper had the appearance of being too long. There was little evidence that the vast majority of candidates did not have enough time to complete the paper. It remains a concern of the examining team that in a paper of this duration reading time is taken into account.

SECTION A

Q1 This question required the recognition of *Hydra* body layers and the description of three features of the phylum Annelida not found in *Hydra*. Most candidates correctly answered both parts of the question. A few candidates named the mesogloea as mesoderm.

Q2 This question required the identification of pyruvate as the product of a process which began with glucose. Processes occurring in a mitochondrion were also identified. The final part of the question required brief description of how fatty acids were respired. Most candidates correctly answered all parts of the question. However, in part (b) some candidates described the metabolism of triglycerides, listing the products of their hydrolysis without continuing to describe the entry of fatty acids into a respiratory pathway.

Q3 This question required the analysis of chromosome lengths and number of genes assigned to each following the Human Genome Project. Most candidates analysed the graph correctly and many understood the significance for males of the difference between the number of genes on the X and Y chromosomes. Some candidates merely stated the Y chromosome had fewer genes without showing an understanding of how this leads to sex-linkage.

Q4 The identification of parts of the moss life cycle from a photograph was well answered. The subsequent parts of the question were less well answered. Candidates were asked to relate features of two contrasting moss species to the habitats in which they survive. There was an element of synopsis in this question in the application of ideas about how plants are supported and relating this to the habitat descriptions. Many candidates did respond to the question asked and provided some of the variety of correct answers. Some candidates repeated general features of the moss plant not relevant to the question asked. The final part of (b) required a comparison across the range of plant divisions. The presence and the lack of a cuticle were the contrasting features most candidates failed to provide.

Q5 This question combined the effect of 'knocking-out' a gene with the analysis of limiting factors in photosynthesis. The question did not require any knowledge of how the gene was 'knocked-out', (a topic for future papers). This was likely to be a difficult question for many candidates not least because part (c) related to aspects of planning an investigation.

(a) Most candidates were aware of the effects of the enzyme Rubisco on plant metabolism and showed understanding of how a plant with less of this enzyme may be slow growing and stunted.

(b) The explanations of how when light was limiting the amount of the enzyme Rubisco made no difference to the assimilation of carbon dioxide and how the amount of the enzyme could become the limiting factor were often very good.

(c) This was well answered with the majority of candidates showing understanding of the need to control an independent variable such as temperature when another independent variable is being investigated. In part (ii) some markers suggested that 'assimilation of carbon dioxide' confused some candidates.

Q6 This question required statistical analysis within a question about the evolution of island species. In part (a) the majority of answers were clear and correct. Some candidates interpreted the number of species as an identification of population size and a few candidates failed to express their answer in a way the markers could understand.

The statistical analysis in part (b) was often well answered. Two major weaknesses of a number of answers were in part (i) a poor statement of the null hypothesis. This has a strict form and is not a description of the biology. Candidates failed to use the phrase, 'no significant difference' and did not refer to the means of the two samples. The probability of a t with the number of degrees freedom (both correctly stated) was often not correctly given for a variety of reasons. 'More than' and 'less than' symbols were confused, a t value from the statistical table was stated and p values which were obviously incorrect provided a spectrum of incorrect answers.

In part (c) the isolation of an island population with the possible result of speciation was well understood by most candidates.

Q7 This question required the analysis of a Mendelian dihybrid cross where the two gene loci interacted to produce three possible phenotypic traits. Few candidates identified the interaction as epistasis. However, the vast majority of candidates correctly completed the cross between two dogs heterozygous at both loci.

Part (c) was much more testing as the data provided was for a single litter of pups. A litter of 10 was a small sample and therefore unlikely to give the exact phenotypic ratio. Brown pups were only possible if both parents were heterozygous at the B/b locus and the probability was very low. A converse argument was used by some candidates that if one the parents was homozygous BB at the B/b locus then brown pups could not be produced. This part of the question required clear understanding of inheritance patterns and unfortunately some candidates wanted to apply recent past paper mark scheme answers. The brown bb allelic combination was now lethal having been produced in part (b).

Q8 This question about the gene for the muscle protein dystrophin required careful reading of a long passage and an awareness of how genetic markers could be interpreted. The devastating effects of a deletion mutation on the structure of the protein were understood by many candidates. The different family histories were indicated by analysis of genetic markers. The question contrasted two mothers, one who carried a deletion mutation (family B) and a second mother who was a genetic mosaic with the mutation in her ovaries. The candidates had to use the information in the question to deduce these lines of inheritance. Many candidates followed the propositions in the question and correctly understood the inheritance of Duchenne muscular dystrophy in both families. This was a demanding question requiring the assimilation of a variety of points and the strength of the candidature was reflected in so many coherent answers.

SECTION B

Q9 The two parts to this question both demanded time to produce comprehensive answers. The role nucleic acids in protein synthesis was generally well understood. However, most candidates omitted precise details of the role of each nucleic acid, such as, at the ribosome t-RNA brings a specific amino acid and the anticodon can only combine with a complementary codon on the m-RNA. The carrying of a specific amino acid is critical for the translation of the code.

In part (b) aspects of safety and ethical issues surrounding gene technology were well articulated by most candidates. A wide range of ethical issues were accepted as relevant by the marking team. The necessity for the inclusion of ethical issues is documented in page 74 of the specification in the section detailing How Biology Works.

Principal Moderator's Report

ASSESSMENT UNIT A2 3 ASSESSMENT OF INVESTIGATIONAL AND PRACTICAL SKILLS IN BIOLOGY

As with previous years the work submitted was mainly of a high standard relevant to that expected at A2 with marking in most centres being well within tolerance. There also tends to be a bigger range of investigations than is evident at AS level.

A1 DEVELOP A HYPOTHESIS

This was generally well carried out by the candidates although in some cases there was no clear link between the biological discussion and the hypothesis stated. A Null hypothesis is not acceptable for two marks in this section.

A2 PLAN A PROCEDURE

Procedures given by the candidates here may not necessarily be the one followed by the whole class. Candidates are expected to choose their own range for the independent variable which can then be amended when carrying out the investigation. Too often all candidates within a centre or teaching group had exactly the same range for the independent variable which might suggest the plan was written after carrying out the investigation or the teacher gave them the range.

A3 PLANNING FOR ANALYSIS

The change to this section regarding the justification of the statistic to be calculated was not well completed by the candidates and not well assessed by teachers. The correct choice of statistic would be awarded one mark with the justification being included for the second mark.

B1-B2 RECORDING AND COMMUNICATING

Many centres recognised excessively long captions and deducted marks accordingly. There are still too many centres assessing tables with collated class data rather than their own individual results and captions from different tables cannot be “mixed and matched”.

C1 ANALYSIS

This section is usually very well carried out with clear tables of parameters and calculations. Some centres still calculate standard deviation from first principles and many provide every calculation both of which are unnecessary. When stating the Null hypothesis for a ‘t’ test, the mean should be included in order to obtain both marks.

C2 INTERPRETATION

The assessment of reliability using the statistics has improved with most centres referring to specific examples of confidence limits to identify reliability across the range of the independent variable. The comment should then directly refer to this assessment.

If a candidate does not obtain the trend expected or something unusual occurs then this would be a good opportunity for discussion which would not just be a repeat of the biological knowledge given in A1.

C3 EVALUATION

This area again has provided the greatest differentiation with many candidates struggling with the assessment of validity. The appropriateness of the range was well discussed in most cases although many candidates failed to recognise when some treatments are not influencing the result and so therefore could be excluded.

The new criterion of outlining another independent variable was poorly carried out in many centres and also incorrectly assessed by teachers. Candidates would be expected to give a variable which has a link to the investigation just carried out and be expected to give a range for that variable. Detailed methods are not required but a brief mention of the procedure to be followed could be given.