Rewarding Learning

GCE AS Biology Revised
Summer 2009

# Chief Examiner's and Principal Moderator's Report

# GCE BIOLOGY REVISED

## Chief Examiner's and Principal Moderator's Report

### Grade Boundaries

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

### Chief Examiner's Report

This was the first series were both new AS specifications were examined. The responses from the well-prepared candidates were of a high standard. The inclusion of questions on the knowledge and understanding of practical procedures within the new longer papers provided a new challenge. The responses to the questions in both papers examining the application of practical procedures were well answered. Practical skills including graphical technique and drawing skills were assessed and these may be repeated in future series alongside other skills, such as, presenting data in a tabular form.

More detailed points about candidates' performance in questions within the individual papers are presented below.

### ASSESSMENT UNIT AS1 MOLECULES AND CELLS

An AS 1 paper was available in January. This paper generated a wide range of marks in the candidature and was therefore discriminating. Many candidates scored well and must be congratulated on their preparation for, and performance in, this examination.

### SECTION A

**Q1** The first part to this question required definitions of 'organ' and 'organ system', and was generally very well done. More discriminating was the second part which required descriptions of the roles of structures within the ileum. There was evidence of confusion between muscularis mucosa and muscularis externa. Still, many candidates scored well.

**Q2** This question on carbohydrates was more challenging. There were a considerable number of candidates who failed in some part of the biochemical test for glucose required in part (e).

**Q3** This question tested the candidates' understanding of the movement of substances through the cell surface membrane. In part (a) phospholipids was identified by the vast majority. Part (b), on the processes of diffusion, facilitated diffusion and active transport was more testing, and many seemed to be confused between the mechanisms of diffusion and facilitated diffusion. Part (c) was even more discriminating and only a minority understood the two routes for diffusion – the

phospholipids bilayer for lipid-soluble substances (or very small molecules such as water, oxygen and carbon dioxide) and channel proteins for water-soluble substances.

**Q4** Interpretation of the cell mass and DNA mass during the cell cycle was tested in this question. This proved to be particularly discriminating. Nevertheless most were able to provide correct answers to parts (a) and (b). However, in part (c) many candidates confused the change in the mass of the nucleus with the change in the mass of the cell and so confused mitosis and cytokinesis, i.e. they considered that the drop in DNA mass per nucleus was due to cytokinesis rather the telophase stage of mitosis. In part (c) few understood the significance of meiosis and although the term haploid was used, and knowledge of four daughter cells was widespread, candidates found it difficult to relate this to the mass of DNA in the nucleus – that with the separation of homologous chromosomes as well as chromatids within two divisions the DNA mass would be reduced to 0.5 arbitrary units.

**Q5** In this question candidates were required to identify four structures from an electron micrograph of plant cells and to calculate the actual diameter of the nucleus. The identification in part (a) was mostly well done though few managed all four: mitochondrion was identified as chloroplast; nucleolus as chromatin; and cell wall as middle lamella. Even more problematical was the calculation in part (b). Too frequently candidates measured the magnified nucleus in centimetres – rather than millimetres – and multiplied by 10 000 to convert to micrometres. Part (c) was well done.

**Q6** The theme in this question was enzyme action and pH. In part (a) most graphs were appropriately well drawn. Captions were frequently good – this was not the case in January – though too many drew short straight lines between the points of what was a correlation. Most candidates knew about the use of buffers in part (b)(i), and understood, in (b)(ii), the need to control temperature even if explanations of its effect were not always detailed. The numerical problem in part (c) was very discriminating. Some were unable to extract 50 minutes from the table (or graph) – the time to digest 200 mg of protein – and many failed to convert to an hourly rate by multiplying by 60. Both parts (d) and (e) were well done.

**Q7** This question, on the polymerase chain reaction (PCR), was particularly testing. Nevertheless, the advantage of PCR (part (a)) was well understood, as was the purpose of heating the DNA sample in step 1 (part (b) (i)). The role of primers was not so well understood (part (b)(ii)) though the use of polymerase enzyme in step 2 (part (b)(iii)) was generally well known. A surprising number failed to appreciate the addition of free nucleotides in step 2 (part (b)(iv). Part (c) was the most difficult for candidates and many simply repeated what was shown in the diagram without describing the sequence of events leading to DNA replication; and so mention of complementary base pairing (between free nucleotides and the separated DNA templates) and of bonding (hydrogen bonds between the base pairs, phosophodiester blonds joining the sugar-phosphate backbone) was all ignored. In part (d), most understood the bonds broken in enzymes through heating, and the use of thermostable enzymes in PCR. Part (e) was well done.

**SECTION B**

**Q8** This prose question required candidates to describe the process of osmosis and then to describe its effects in both animal and plant cells. While there were many good accounts of osmosis there were still some who struggle with the concept of ‘water

potential' and persist with concentration. Only the best accounts were able to provide definitions of water potential in terms of the free energy of the water molecules or of the effect of solutes in attracting clusters of water molecules around them. Most were able to describe the basic effects of osmosis on animal and plant cells. However, some misused the terms 'hypotonic' and 'hypertonic', while some showed an inability to select relevant information and so described the role of osmosis in whole organisms (e.g. uptake by root hair cells, or water movement along the apoplast and symplast). Only the best accounts made reference to the effect of the cell wall in inducing turgor and so reducing water uptake (or that when fully turgid no more water is taken up since the water potentials internally and externally are equal). The quality of written communication was also generally good, with well-sequenced accounts that frequently incorporated sound biological terminology.

## ASSESSMENT UNIT AS2 ORGANISMS AND BIODIVERSITY

**Q1** The specification for AS unit 2 is a mixture of familiar topics from the previous specification, (2.1 Transport and Exchange Mechanisms), new additions at this level, (2.2 The Adaptation of Organisms and 2.3(a) The Variety of Life) and topics new to the specification, (2.3(b) Human Impact on Biodiversity). In this first response candidates showed that they were well prepared, especially for topics new to the specification.

Most of the questions were very discriminating allowing candidates to apply their knowledge and understanding in both familiar and unfamiliar contexts. Responses to questions 1, 5(a) and 6(b) were particularly good across the whole range of candidates. The response to the biodiversity question was also pleasing with answers showing a good appreciation of the various aspects of this topic.

### SECTION A

A well answered question which tested candidates' ability to identify words associated with oxygen uptake and carriage from a written description. The most common mistake was to substitute haemoglobin for myoglobin.

This is a style of question which will be repeated as it provides a straightforward start to the paper.

**Q2** The distribution of two species of periwinkles on a rocky shore and a number of their adaptations were described. The responses were often incomplete in part (a) as many candidates did not explain how an adaptation could be of an advantage in the context of the conditions on the upper shore. In (b) some candidates provided good suggestions for *L. littorea* outcompeting *L. saxatilis* on the lower shore. However, many suggested *L. saxatilis* being better on the upper shore didn't need to compete with the lower shore specialist.

**Q3** The drawing of a leaf which had xerophytic features. A drawing showing blocks of tissues remains a difficult skill for many candidates. This was a relatively simple leaf structure easily illustrated by slightly curved horizontal lines. Each of the five marks required particular components of the drawing.

- A series of lines drawn to illustrate blocks of tissue, there was no need to include cells.
- The blocks indicating upper epidermis, (shown as one or two layers of tissues), the palisade and spongy mesophyll layers, and the lower epidermis were required to

show completeness of the drawing. The inclusion of vascular tissue was not assessed.

- The slight curvature of the leaf was an indicative feature required to illustrate the photograph.
- Upper epidermis wider than lower epidermis indicating the proportionality of the drawing.
- The lines drawn must be unambiguous, (not sketchy or incomplete).

The xerophytic features were often well observed. However, explanations of how they acted as an adaptation were poor, many just stating that the feature restricted water loss.

**Q4** The context of flatworm feature was used to asked questions about exchange between tissues. The initial part of the question requiring a definition of a species was well answered with only a small number of candidates explaining that each species belongs to larger group, a genus, and how this fits within a hierarchy system of classification. In part (b) the simple diagrams provided were well used by the majority of candidates. In part (ii) too many candidates referred to easier diffusion without explaining why diffusion would be easier.

The information in the question was less well used in part (c). There were general answers about the introduction of alien species. Some candidates suggested the flatworms and earthworms were competitors. A number of candidates failed to link the loss of the earthworm population with a subsequent decrease in biodiversity.

**Q5** A question requiring identification of different types of white blood cell and the influence of altitude on oxygen carriage by red blood cells. A large number of candidates scored well in part (a). There were vague answers such as "fight disease" or "prevent infection" for the functions of each cell type. Part (b) was much more demanding as oxygen uptake was linked to altitude. Some candidates answered (i) incorrectly and confusingly in part (ii) explained that more red blood cells were necessary as the partial pressure of oxygen was low. The suggested adaptations of the Quechua Indians included those which prevented excessive heat loss. This appreciation of another aspect of living at high altitude was given credit as well as adaptations related to better oxygen loading.

**Q6** Aspects of using a potometer and explaining results of an investigation using a potometer. A question requiring knowledge of a practical procedure would in the past have been found in paper 3A. It is very pleasing to report that most candidates provided answers, in part (b) especially, which showed practical experience of using a potometer. In part (a) some candidates confused the assumption with general points about controlling or measuring variables. In part (c) a large number of candidates described the results. In many cases they almost inadvertently gave a partial explanation. The inclusion of the black plastic bag meant that many mistakenly explained that less water was taken up as less water was used in photosynthesis.

**Q7** The biodiversity found in deciduous and coniferous woodlands was the context for questions about the human impact on biodiversity. This question format with information presented as part of a comprehension and with data presented also in graphical form was used to establish the assessment of the knowledge of the various aspects of the human impact on biodiversity. The question was well answered and did provide the examining team with information about the candidates' appreciation of this topic.

Part (a) was frequently well answered, although a few candidates tried to use information in the passage for features of the whole kingdom Plantae. The term niche used in Part (b) needs some explanation.

The earliest use of the term niche described a functional role of a species in the community, (the species job/role). The development of this concept emphasises the use of the available resources by the organisms of a species and their tolerance of the prevailing environmental conditions. A contemporary view focuses on what actually happens between the tolerance limits and especially how resources are partitioned between competing organisms of different species. In the specification this concept is developed through 2.2.1 and 2.2.2 (page 25). The adaptations of organisms of a species are ways of meeting particular environmental challenges. The range of tolerance of a particular species to an ecological factor suggests the niche the species can occupy. In part (b) the various species of vascular plants which can exploit the light available in spring before the deciduous trees have a full canopy exemplifies this concept.

The description of the trends in part (c) was well answered, although some candidates quoted figures without explanation or provided explanations for differences between the two woodland types. Again (d) was well answered. In part (e) some candidates ignored the reference to economic. There was a wide variety of strategies suggested in part (f) and many were well explained.

**SECTION B**

**Q7** The question asked for an account of the co-ordinated sequence of events which result in the flow of blood through the heart during one cardiac cycle. An account requires a story to be told providing the main points with an explanation of how they interact. The emphasis in the marking of this continuous prose was to look for the sequence of the various events within the cardiac cycle. List of events and statements unrelated to consequences frequently were not given credit. Many candidates scored well in this question with relatively few candidates unable to score any marks.

The concept of the atria filling with blood during diastole was misunderstood by some candidates, especially the subsequent increase in pressure in an atrium leading to the opening of the A-V valve. A number of candidates discussed valve closure as the stimulus for contraction. However, in most cases the roles of the SA node and the AV node were well understood.

The poorly sequenced answers often with irrelevant information were penalised in their marks for Quality of Written Communication.

**Principal Moderator's Report**

**ASSESSMENT UNIT AS3**

The standard of work submitted for external moderation was very good. Teacher annotation was often excellent with many centres supplying appropriate mark schemes. Generally, teachers have embraced the new two mark system successfully. It is important that inaccuracies are penalised one mark. Zero marks for any of the criteria should only be awarded if it is not addressed or is completely wrong.

Having to produce a graph for assessment has reduced the variety of investigations undertaken. Determination of water potential, enzyme investigations and beetroot permeability remain as the most common pieces of work. However, it is encouraging to see some centres still providing ecological studies especially those relating to new areas of the specification. It is important the complexity of the investigations is beyond the level required at GCSE to enable candidates to successfully meet the criteria e.g. for enzyme practicals it would be expected that candidates should be calculating and plotting rates of reaction.

Care should be exercised when providing candidates with guidance. Responses given by candidates should reflect their own ideas. It is acceptable to review work and return it to candidates to complete, as long as the advice remains at a general level, enabling the candidate to take the initiative in making amendments.

**IMPLEMENTING**

It is entirely at the teacher's discretion as to how successful the candidate was in carrying out the procedure. Candidates should carry out the full range of the independent variable and not just replicates of a single value.

**RECORDING AND COMMUNICATING**

It is essential that individual results tables are provided for assessment and not pooled results tables. These are only required for assessing reliability.

Some centres had problems choosing an appropriate graphical technique. Choosing only two values for the independent variable is not really appropriate for graphical analysis.

Best fit lines should reflect the most appropriate division of the points and in most cases ruled lines from point to point are sufficient.

Captions for both methods of recording should be concise and contain the biological material to be used.

**INTERPRETATION**

When a specific hypothesis and prediction have been supplied to the candidates before implementing the procedure, there is a more distinct and concise direction to the explanation of the trend. This appears to benefit the candidate in their use of biological knowledge. The last three criteria in the interpretation were frequently marked out of six marks which is appropriate. However, it is also possible for candidates to score two marks for communication when they have been deducted marks for their explanation or biological knowledge.

As with the previous specification, it is important the biological knowledge given by candidates is at a sufficient level for AS.

**EVALUATION**

This section has again provided the biggest degree of differentiation amongst candidates. Whilst candidates are able to describe whether or not the measurements are appropriate, there is seldom a discussion on the implications of the measurements e.g. why measuring to two decimal places for small masses reduces error or the benefit of quantitative values given by the colorimeter.

The major area of concern is with understanding the concept of validity. Candidates frequently confuse this with reliability. The candidates should be encouraged to look for factors that are not / cannot be controlled and then further discuss the implications of this with respect to validity.

It is important that a table of pooled results is provided to the candidates in order to assess variation within the data. It is not necessary to discuss the variation of each independent variable; rather that the candidates highlight the extent of reliability by quoting specific examples.