

GCE Biology
(January Series) 2011

Chief Examiner's Report

biology

Foreword

This booklet contains the Chief Examiner's Report for CCEA's General Certificate of Education (GCE) in Biology from the January 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 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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GCE BIOLOGY

Chief Examiner's Report

Grade boundaries

| AS Units 1 and 2 | |
|--------------------------|----|
| Weighting 20% | |
| Maximum Uniform Mark 120 | |
| A | 96 |
| B | 84 |
| C | 72 |
| D | 60 |
| E | 48 |

| A2 Unit 1 | |
|--------------------------|-----|
| Weighting 20% | |
| Maximum Uniform Mark 120 | |
| A* | 108 |
| A | 96 |
| B | 84 |
| C | 72 |
| D | 60 |
| E | 48 |

Assessment Unit AS 1 Molecules and Cells

A large number of candidates took this assessment unit, only some of whom were resit candidates. The paper generated a wide range of marks 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. However, few candidates scored at the very top end of the mark range. Some of the questions were more challenging than others, assessing more difficult concepts or the application of understanding. Many candidates appeared to lack the ability to deal with these question types through their inexperience in applying their understanding. Undoubtedly, with greater practice this will improve.

Section A

- Q1** This question on prokaryotic and eukaryotic cell structure was very well answered. Most candidates scored full marks.
- Q2** This question on plant cells and osmosis was a little more challenging though most candidates showed a thorough understanding of the topic. The vast majority were able to calculate the water potential and were able to explain the movement of water out of the plant cell. It was pleasing to see that most use the term 'water potential' rather than the incorrect 'water concentration'. The drawing of a plasmolysed cell was more demanding with a number unable to distinguish the protoplast from the vacuole.
- Q3** This question tested the candidates' understanding of protein structure. Some answers were very good, demonstrating thorough knowledge of the proteins and the biuret test. However, in part (b), many candidates failed to accurately relate the different levels of protein structure to the type of bonding involved. Also, in part (c), too many failed to record the colour change of blue (light blue) to mauve (or lilac or violet or purple).
- Q4** Aspects of plant cell structure were tested in this question. In part (a)(i), the cellular structures were generally well identified from the photograph, with the most difficult feature being the grana or lamellae within the chloroplast (feature A). Also, candidates should appreciate that nuclear membrane does not

adequately describe the nuclear envelope (feature D). In part (a)(ii), few candidates recognised that the nuclei were forced against the cell wall simply because the cell was turgid. 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. Still, the calculation was more discriminating than might have been expected since it would be surprising that there are any candidates who have not practiced a determination of magnification.

Q5 With a range of skills and understanding being assessed this proved to be particularly discriminating. Part (a) dealt with the identification of features within the cell surface membrane. This was often well done though too often answers were not sufficiently precise. In part (b) candidates needed to analyse tabular data about different mechanisms of membrane transport. Identification of the mechanism was often well done though the reasoning was not always accurate. For example, for mechanism 2 – facilitated diffusion – it was not sufficient to say that ‘oxygen had no effect’ (so that respiration was not involved) since that did not distinguish it from simple diffusion (mechanism 3); the candidate needed also to note that there were ‘no carriers involved’.

Q6 This question tested the area of DNA technology. It was a most discriminatory question.

In part (a), candidates were frequently unable to distinguish ‘restriction sites’ and ‘microsatellite repeat sequences’. Indeed, the latter would appear to be an area of relative weakness.

In part (b), candidates were asked to analyse restriction fragment length polymorphism (RFLPs). This was a new topic and subsequently very testing.

Q7 This question involved an analysis and evaluation of an experiment about the digestion of jelly by protein-digesting enzymes. Again, it was a most discriminatory question.

While part (a) was often well done, too many considered this breakdown as ‘catalysis’ rather than the more accurate ‘hydrolysis’. Part (b) was also discriminating. The construction of the graph was quite well done but frequently lacked a caption (title) or had points joined by rough curves rather than the more appropriate ‘short straight lines’. The trends were often well identified though many got the activity the wrong way round, i.e. suggesting that a high value (for area remaining) represented high activity rather than the reverse.

Part (c) was often well done though many answers lacked sufficient detail.

In part (d), candidates frequently made valid suggestions about possible problems in the procedure used. However, it is not sufficient to simply suggest that problems arose through human error, e.g. that the volumes were measured wrongly.

Section B

Q8 This prose question required candidates to discuss the structure of the nucleic acids, DNA and RNA, as well as describe the process of DNA replication. Answers were most frequently of a very high standard and many candidates scored well. The quality of the responses was often impressive and the topics seem to be well understood. The quality of written communication was often

good, with well-sequenced accounts that incorporated sound biological terminology. This is encouraging as it is an area where standards had seemed to be slipping.

Assessment Unit AS 2 Organisms and Biodiversity

This was a very discriminating paper, which allowed candidates of all abilities to demonstrate their knowledge of the topics examined. Several questions (Q2, Q6 and Q8) tested candidate's knowledge of experimental techniques and proved to be very discriminating. Q3, 6 and 8 required candidates to analyse data in a graphical form while Q5 and 6 involved the interpretation of tabular data. In Q4, candidates had to produce a block diagram of the section provided while Q7 asked candidates to extract information from a diagram. In Q9, candidates were required to select and sequence their ideas on the structure of haemoglobin and its role in the uptake and delivery of oxygen.

Section A

- Q1** A surprisingly discriminating question which tested candidate knowledge of feeding in the Kingdom Fungi. The term 'lysotroph' in part (a) proved problematical to many.
- Q2** In this question candidates were examined on their knowledge of the use of bicarbonate (hydrogen carbonate) indicator. In part (a), a large number of candidates could not name the indicator. In part (b), most were able to highlight control of temperature although many suggested that the pondweed needed to be in water as it was an aquatic plant – strange as the pondweed was in a boiling tube full of indicator before it was placed in the beaker of water. In part (c), only the well-prepared candidates understood the concept of the compensation point with many suggesting that the pondweed would not photosynthesise in experimental setup B.
- Q3** A generally well answered question on heart structure and function. Most candidates understood the term 'systole' in part (a). In part (b), there were many excellent answers, although some did not answer the question and compared atria to ventricles instead of comparing the right side to the left side as asked.
- Q4** In this question candidates had to make a block diagram of the *Erica* section provided and then explain the role of the thick cuticle and epidermal hairs in reducing water loss. In part (a) the diagrams varied greatly in quality and appropriateness with many providing learned-off 'textbook' diagrams of mesophytic leaves. The diagrams which attempted to accurately portray the *Erica* section frequently added unwanted cellular detail. In part (b), a large number of answers just repeated the question stem for the thick cuticle and said that it reduced water loss without giving any idea of how this was achieved. Epidermal hairs were generally well understood although some answers seemed to confuse them with root hairs for water uptake.
- Q5** A well answered question on sampling methods, the use of the Simpson's index and hedgerow management. The most discriminating question parts were part (a) where many candidates did not understand the concept of when systematic sampling with a transect would be used and part (c) where many candidates could not describe two strategies to maintain a good hedge. It was pleasing to note that the Simpson's index calculation and interpretation was generally well understood.

- Q6** This was a discriminating question, which required candidates to analyse and interpret data on stomatal counts and transpiration rates in daffodil leaves. In part (a)(i), most candidates were able to calculate the mean count for the lower epidermis but in part (ii) many ignored the word ‘variation’ in the question stem and simply described the trends evident in the results. Part (b) was generally well done, although some candidates ignored the fact that the mean stomatal count for the lower epidermis was smaller than the upper epidermis and answered in relation to the learned-off scenario of lower having a higher value than the upper. In part (c) many answered their own question, starting with root hair cells, the apoplast and symplast routes across the cortex etcetera instead of starting with water loss from the leaf as was instructed in the question stem.
- Q7** This question which tested candidate knowledge of blood vessels and cardiovascular disease proved to be very discriminating. In part (a) many candidates were able to extract two pieces of evidence from the diagram to allow it to be identified as an artery, but many answers were vague, lacking biological knowledge. In part (b) the recurrent problem with smooth muscle was highlighted again – many seem to believe that the smooth muscle either produces a peristaltic wave or its ‘smoothness’ reduces frictional slowing of blood. Part (c) was very discriminating with the terms ‘atheroma’ and ‘atherosclerosis’ not well known. In addition, the term ‘coronary thrombosis’ was frequently ignored with answers relating to circulation problems in the general body and not specifically in the heart.
- Q8** This was a well answered question which required candidates to analyse and apply their knowledge to a series of graphs relating to management of short rotation coppicing (SRC). The majority of candidates had no difficulty in interpreting the graphical data with the main difficulty for most candidates occurring in part (c)(i) where their knowledge of an appropriate sampling technique was tested. The final question part (d) also proved problematical with many failing to realise that the question related to the total number of insects in each SRC and how an increase in insect number may be of benefit to overall SRC biodiversity.

Section B

- Q9** This question on the structure of haemoglobin and its role in both oxygen uptake and oxygen delivery to strenuously exercising muscle proved to be very discriminating. In part (a) it was obvious that many candidates seem to confuse the molecule haemoglobin with an erythrocyte. In addition, many answers included detailed accounts of ventilation and alveolar structure ignoring haemoglobin structure as requested in the question. In part (b), a large number of answers ignored the fact that exercising muscle would cause the partial pressure of oxygen to fall facilitating oxygen delivery and jumped directly to the Bohr effect caused by carbon dioxide and temperature increase. The role of myoglobin was generally well understood although many candidates seem to think that myoglobin circulates in the blood with haemoglobin.

Assessment Unit A2 1 Physiology and Ecosystems

At 2 hours in length and 90 marks being allocated, this paper was demanding. There was no evidence of candidates having too little time. However, examiners did indicate that some candidates lost marks as their handwriting was very poor with parts of answers

illegible. Generally, responses were of a good standard. All questions provided differentiation between candidates and gave all abilities the opportunity to show what they knew, understood and could do. The 18 marks available in Section B is a large influence on the final grade obtained by the candidate.

The assessment criteria require most questions to include parts assessing the candidate's ability to apply their understanding of biological concepts. In this paper most of the information supplied in the paper was in the form of tables (6) and graphs (4). A significant number of candidates poorly expressed their answers when explaining trends or passing comment on information within a column of data or across a row in the table. The use of column and row headings would have greatly facilitated many answers. There was much better use of axes labels in the analysis of graphs. However, most candidates did not appreciate the need to comment on threshold values in Q6 and 7. Few biological processes begin from a zero/zero point, although some candidates at AS level still include this point in plotting points on a graph.

Section A

- Q1** Candidates responded well to this cloze procedure question about terms relating to succession.
- Q2** This question involved the interpretation of data about the effects of artificial plant growth substances was well answered except for part (a). Few candidates were able to state the part of the plant stem stimulated by gibberellins.
- Q3** The application of knowledge and understanding of the nervous system, especially the mechanisms at the synapse, was testing for many candidates. The best answers made good use of the relevant biological terms and fully understood the contrasting effects of nicotine and alcohol. Some candidates tried to make use of a limited knowledge of the stimulating effects of nicotine and depressing effects of alcohol without the necessary use of accurate scientific terminology.
- In part (a) some candidates thought nicotine was a competitive inhibitor of the action of acetylcholine rather than 'nicotine acts in a similar way to acetylcholine'. The answers to part (b) were better as most candidates understood the movement of positive ions out so that the neurone could produce this increased potential difference. Candidates were not required to show knowledge of the nature of these positive ions and references to particular were ignored as long as it was positive kept out (or negative retained).
- Q4** Candidates responded well to the flow diagram of the fate of incident light energy on green plants and few candidates had difficulty with the use of standard form to express the large values in the diagram. The definition of the term Net Primary Production was less well answered than the subsequent calculation of the value of NPP for the area of grass. In part (b) the interpretation of the graph showing NPP at different temperatures was particularly good.
- Q5** The growth of maize is now a common sight in Northern Ireland and was illustrated by two photographs in the question. This question provided data which illustrated how the growth of maize is now economic and the subsequent use of the maize in feeding cattle. Candidates should appreciate why photodegradable plastic is used for this crop and know that the crop is for animal consumption. The question assessed the ability to extract the relevant information from a series of tables. The questions was generally well answered

although especially in (d) some candidates repeated figures from the table without selecting the relevant points that there were difference in what was 'eaten' and 'absorbed'.

Q6 Many candidates made good use of their knowledge and understanding in parts (a) and (b) of this question about the release of ADH and the intensity of thirst in response to increasing plasma solute concentration. In both graphs the stimulation of ADH release and the increase in thirst began not at zero plasma solute concentration but at a value above $285 \text{ mOsmol kg}^{-1}$. In part (a) the mark scheme provided enough opportunities for full marks without making this observation. In part (c) it was critical to reference this threshold point.

In part (d) candidates were required to design a plan to test a hypothesis and most achieved high marks. This may have been attributable to a generous mark scheme as well as good understanding of the variables involved in an investigation.

Q7 This question about the nitrogen cycle was well answered with the following exceptions. Many candidates were unable to label the flow diagram of the cycle. In part (b) the fact that wheat produced a yield in fields where no fertilizer had been added was not mentioned. In part (c) a few candidates did not describe the role of bacteria in producing the high BOD.

Q8 This novel question about introduced reindeer on oceanic islands was particularly demanding for many candidates. In part (a)(ii) many candidates repeated their answers to part (i) and did not suggest what should happen in the event of reindeer removal. This part of the question was assessing the candidates' appreciation of the way in which society uses biology to inform decision-making. [Reindeer removal from South Georgia, shooting from helicopters, began at the beginning of March 2011, details in an article in The Times, Saturday 19 February]. The comparison with the growth and decline of the introduced reindeer population on St Matthew island emphasised the problems of uncontrolled population growth. Many candidates did not appreciate the absence of controlling factors on the island and why mainland population growth would be different.

Section B

Q9 Well-prepared candidates achieved high marks in this account of immune responses. In applying their knowledge and understanding to what happens at the site of a wound most candidates did not appreciate that existing memory cells would recognize the invading pathogens and no infection develops as a result. There was also some confusion about the distinction between humoral and cell-mediated responses. Weaker candidates described both responses in terms of attacks on pathogen cells and some referred to T-lymphocyte responses only in the context of transplanted tissues.

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