

CCEA GCE - Biology
(January Series) 2012

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 2012.

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

The three winter examination papers (AS1, AS2 and A21) taken in January 2012 provided further 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 at this stage, it is useful to comment on some features common to the suite of papers.

Candidates, in general, attempt all questions with there being very few examples of questions, or question parts, not attempted. It is still very apparent that many candidates lose marks (often a significant number) through not answering the questions as they are asked – several examples of this will be alluded to as candidate performance in individual papers is addressed. As noted in the Summer 2011 report, the quality of answers relating to practical work can be very variable; the quality of answers can be even more disappointing if the question part testing understanding of practical technique is set in an unfamiliar context.

In January all three papers had an 'extra lined page' at the end of the question paper. Many candidates used this facility well but it would be useful to examiners if candidates would identify when a question part is to be continued on the extra lined page. Surprisingly, a number of candidates declined to use the extra lined page but used supplementary booklets instead; this tended to be a centre based phenomenon – it would be very useful if teachers/lecturers could ask their students to use the extra lined page in preference to the supplementary booklets. A number of examiners reported that the overall quality of handwriting has deteriorated in recent years. While there may be some evidence that this trend exists, it is important to note that many candidates produce succinct well written answers that are a pleasure to read.

Assessment Unit AS 1 Molecules and Cells

The candidate performance in this paper produced a very wide range of marks, with capable students being suitably rewarded with high scores. There was evidence of some excellent teaching and thorough personal preparation on the part of the candidates. Generally most candidates attempted all of the questions and there were few blank spaces evident in the scripts. Whilst there was a fair degree of reading required to answer some of the questions, there was little evidence that candidates had insufficient time.

On the whole, calculation skills tested by working out a magnification and R_f value were of a good standard, but there was a poor performance in graph drawing skills, especially in selecting the correct type of graph and constructing an appropriate caption. As in previous examination series, the questions testing practical procedures proved problematic. Candidates must be made fully aware that their understanding of standard procedures indicated in the content of each unit will be tested in the written papers.

The perennial issue of biological terminology was also a problem for some candidates, with simple recall of definitions causing difficulties for many. Candidates who achieved higher marks were those who showed a mastery of correct terms and clearly displayed a progression in expression from GCSE level.

Careless reading of questions was evident in some responses, either when crucial information was overlooked or when candidates failed to identify the type of information which was required in the answer.

Section B allowed the awarding of up to two marks for QWC and significant numbers of candidates failed to reach the standard required for the maximum. Whilst effective written communication was formally rewarded in Section B, reasonable accuracy in spelling of key terms was expected in all responses throughout the paper, as were logically sequenced and clearly expressed ideas.

Section A

- Q1** The first question on any paper ought to allow candidates to settle in to the paper without making high demands of their powers of analysis, and the thinking skills required for this question were not particularly challenging. However, a surprisingly large number of candidates performed badly in what was essentially a straightforward recall task, such that this question was quite discriminating even at the A/B boundary. Glucose was a common erroneous response given for the first part of the question.
- Q2** Most candidates attained the marks for part (a) but part (b) proved to be very demanding. In this discriminating question, candidates generally showed poor understanding of the relationship between the number of recognition sites and the number of fragments produced by restriction enzymes. Some candidates correctly answered part (b)(i) but could not apply their knowledge to the more complex situation described in part (b)(ii).
- Q3**
- (a) Part (a) required candidates to describe the shape of the graph of percentage inhibition against concentration of taxane, and with 3 marks available the three distinct regions of the graph should have been discussed. Some candidates failed to undertake the full description required, but by far the most common error in this question involved references to rate or speed. Candidates frequently described a small rise as 'slow' and/or a large rise as 'quick' but the variable on the x-axis was not time, so such responses were penalised. A significant number of responses to part (a) included some element of explanation which gained no credit.
 - (b) Part (b) was generally well answered, although quite a few candidates incorrectly referred to the prevention of chromosomes being pulled apart during anaphase, rather than chromatids.
- Q4**
- (a) Most candidates scored well on this question, particularly in part (a) where it is pleasing to note almost universal use of the term water potential in describing osmosis. Significant numbers of candidates seemed unaware of the concept of osmosis as 'net flow'.
 - (b) In part (b) marks were lost due to vague references to movement through the membrane and lack of relevant terminology, and a large number of candidates confused the route for the two types of molecule. Some candidates misread the question and described the mechanism of membrane transport (i.e. osmosis and facilitated diffusion) rather than the pathway.
- Q5**
- (a) Identification of structures on the electron micrograph was of a good standard and the magnification calculation was done with a high degree of accuracy. Marks were most often lost when candidates measured in cm and then used an inappropriate conversion factor to convert this into μm . In part (a)(iii), some candidates failed to appreciate the significance of the large amounts of RER and vesicles and references merely to the presence of these organelles were insufficient to obtain the marks available.

- (b) Part (b) was generally well answered although there was evidence that some candidates were unable to differentiate between structural property and role.
- Q6** (a) Part (a) tested the reasons for a procedure and although few candidates would have first-hand practical experience of PCR, most appreciated the use to which it is put.
- (b) (i) In part (b)(i) appropriate terminology was often lacking with candidates comparing 'DNA strands' or merely 'DNA' of the ladybird species rather than 'bands'. A number of candidates failed to comment on the absence of the two-spot ladybird, and were therefore unable to access the second mark.
- (ii) In part (b)(ii), the most common mistake was to ignore the question stem and fail to interpret the DNA profiles with reference to the prey. Simple comments on the similarities/differences between the profiles from each site were not creditworthy.
- Q7** Very few candidates scored highly in this question which was clearly the most demanding on the paper.
- (a) (i) In part (a)(i) it was obvious that many candidates did not understand the idea of accuracy in a procedure, with responses most often relating to issues of reliability or performing a fair test.
- (ii) The reason for the use of filters in the colorimeter in part (a)(ii) was also highly problematic for candidates; many suggested that a blue filter 'filters out blue light' and 'lets other colours pass through'. Some were rewarded for stating that the orange solution would absorb blue light best, but there was little appreciation of the actual underlying reason i.e. a more discriminate range of percentage transmission values would be obtained.
- (b) (i) A surprisingly low number of candidates obtained full marks for drawing the bar chart in part (b)(i). The most common errors were producing an insufficient caption or having bars which were touching. A significant minority of candidates produced a line graph, despite plotting a discontinuous non-quantitative variable on the x-axis.
- (ii) The interpretation of the data in part (b)(ii) was a highly discriminating question and many candidates scored poorly in this section. Frequently there was confusion over whether a high pH meant more acidic or less acidic and many candidates failed to comprehend that high transmission values indicated low enzyme activity. Because of these errors in understanding, only a few of the better responses went on to account for the reduced enzyme activity due to denaturing.
- (c) In part (c)(i) there was good recall of the type of inhibition, but more commonly in part (c)(ii) the graph was wrong, as many candidates incorrectly reproduced the enzyme activity/substrate concentration graph which they had learnt rather than the level of inhibition/substrate concentration graph which was required.
- Q8** (a) This question was well answered by most candidates particularly in (a). It is pleasing to note that fewer candidates are leaving blank boxes in this type of question.

- (b) Part (b)(i) showed more variability in the standard of responses, and some candidates showed little recall of the accepted procedure used to prepare and run a chromatogram. The specification content explicitly refers to this practical procedure and it is expected that candidates will have personal experience of paper chromatography. A few candidates ignored the instruction in the question and went on to describe how the chromatogram could be developed.
- (c) The responses in part (c) of this question were of a high standard and most candidates correctly identified the amino acid following an accurate calculation of the R_f value.

Section B

There was a good spread of marks in this question, which was reasonably straightforward and easily constructed into a logical sequence. A significant number of candidates scored highly, but this was contrasted with a small number of candidates who were unable to write anything at all.

Many candidates were able to name the layers of tissue in the ileum, but did not always locate them correctly in relation to surrounding tissues. In some cases there was uncertainty or lack of clarity about the exact location of particular structures and common errors included confusing the structure/function of *muscularis mucosa* with *muscularis externa*, and describing the villus structure as if it constituted the whole ileum. Vague statements (such as ‘capillaries in the villi are used to absorb nutrients’) were not precise enough to reward at AS level, since they showed little progression of understanding from GCSE. There was evidence of some confusion over the role of Paneth cells and centres are reminded of Specification Revision 2 (25 May 2010) in which Section 1.8.2, relating to Paneth cells, was updated.

In this section, candidates are expected to answer in continuous prose and there are up to two marks available for QWC. Many candidates did not score two marks for QWC and centres should refer to Section 4.4 of the specification and also make use of the published mark schemes to advise candidates as to what is expected of them.

Some candidates illustrated their responses with a diagram of a transverse section of the ileum or villus, but in most cases they reiterated the same marking points given in the body of their textual response.

Assessment Unit AS 2 Organisms and Biodiversity

This paper generated an extremely wide range of marks in the candidature and was successful in discriminating among candidates of different abilities. The full range of marks (zero to full marks) was achieved in every question. 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.

While many candidates performed well, exhibiting good preparation for the examination, there was also much evidence that suggested a lack of revision of some topics. Questions involving practical skills were generally better answered in this paper than in other recent AS papers. 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(c)

and Q6(a) and (b). 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 Q3 and 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 Q7(a) specifically asked for a caption and in Q8(b) many ignored the blood system).

Section A

- Q1** Many candidates showed good knowledge in this question on ecological terms, with the majority scoring 3 or 4 marks. Edaphic factors was least well known.
- Q2** This question, using a photograph of a hydrophytic leaf, allowed candidates to score high marks. However, many lost marks by not being specific concerning gas movement **within the leaf** in part (b) and **into** the leaf in part (c). There were also many who thought the only role of stomata was transpiration.
- Q3** This question considered the use of the Audus apparatus to measure oxygen output as a result of photosynthesis.
- (a) In part (a) a common error was to state that sodium hydrogen carbonate absorbs CO_2 .
 - (b) In part (b) a surprising number could not identify a suitable control variable.
 - (c) In part (c) the majority could describe trends but found the explanations, re limiting factors, difficult.
- Q4** This classification question proved to be very discriminating across the whole ability range.
- (a)& Part (a), concerning differences between pro and eukaryotic cells and part (b)
 - (b) concerning the species name were generally well answered.
 - (c) While many candidates scored well in part (c) concerning feeding in fungi there was also a significant number who failed to gain marks due to poor expression and poor sequencing of facts.
 - (d)& Parts (d) and (e) asked candidates to apply their knowledge of the different
 - (e) kingdoms, by asking why fungi and algae are no longer included in the plant kingdom. While this novel approach was generally well handled by many candidates, there were some, who obviously understood the topic, who failed to gain maximum marks due to imprecise answers (e.g. by recognising that fungi have chitinous walls, without stating that plants have cellulose).
- Q5** This biodiversity question proved challenging for many.
- (a) The calculation in part (a) was poorly handled by many, as a large number of candidates used the wrong denominator.
 - (b)– The majority scored highly in parts (b), (c) and (d) concerning adaptations and
 - (d) selection.
 - (e) Part (e), requiring straight recall of facts concerning evidence used to classify organisms, was generally answered poorly by the majority.

- (f) Part (f), requiring candidates to apply knowledge to work out relationships between the species described in the passage, was very poorly done.

Q6 This question concerning the blood system proved difficult for many.

- (a) Part (a) was a straightforward question on blood clotting. It was answered well by many but a significant number of candidates lost marks by lack of precision in sequencing of events.
- (b) (i) Many candidates lost marks in part (b)(i) by focusing on the Bohr shift as a consequence of increased CO₂ levels rather than on the effects of temperature, which was shown in the graph.
- (ii) In part (b)(ii) many lost a mark by failing to read the scale correctly (e.g. by giving answer of 4.2 kPa after drawing correct lines on graph to show 4.4 kPa).
- (iii) Part (b)(iii) asking candidates to work out why foetal haemoglobin would have a different dissociation curve was generally handled well by many.
- (c) Part (c) concerning co-operative binding of O₂ proved to be very discriminating.

Q7

- (a) The majority of candidates were able to draw out an appropriate table in part (a) but many lost a mark by not providing a caption, as required in the question.
- (b) Although part (b) was generally well answered there were many vague answers that failed to indicate sufficient difference in **both** moisture and light levels preferred by each species.
- (c)&(d) Parts (c) and (d), requiring candidates to display their knowledge of practical ecological techniques, proved challenging for many.

Section B

Q8 This prose question proved to be the most discriminating question on the paper.

- (a) Part (a) required candidates to describe the relationship between surface area and volume in metabolism and to explain how this relationship is affected by increasing body size. The majority of candidates found this difficult, even though this theme is a fundamental part of this assessment unit. A significant number 'changed the title' and wrote about heat loss and surface area.
- (b) Part (b) required candidates to use the lungs and blood system to illustrate how mammals compensate for increasing body size. Many failed to score full marks by restricting their answer to what happens in the lungs and ignoring the role of the blood system.

Assessment Unit A2 1 Physiology and Ecosystems

This paper was also very effective in discriminating among candidates of different abilities although only a very small number of candidates scored in excess of 80 of the 90 available marks. In general, the most able candidates performed well throughout the paper, but many other candidates tended to have particular difficulty with those questions involving application of knowledge in unfamiliar contexts, in particular in question parts 2(a)(ii), 3(b)(ii), 7(c)(i) and 8(c)(i).

Section A

- Q1** This question required knowledge of phagocytosis. Many candidates obtained all three marks available. Candidates who failed to obtain three marks often produced answers that lacked detail or answers that were not linked to the information provided. Some candidates mixed up the key biological terms in this question (e.g. lysosome and phagosome) and produced inaccurate answers or answers lacking detail, e.g. the lysosome fused with the bacteria or the bacteria were killed.
- Q2** Q2, an eight mark question on the eye was generally well done, having a modal mark of seven. Parts (a)(ii) and (b) were well answered by a significant majority of candidates, although a small minority lost a mark in part (b) through referring to the suspensory ligaments contracting. In part (a)(iii) a majority of candidates correctly referred to retinal convergence, either by name or description, in their answers. A smaller number gained the second mark by stating that there was a smaller number of cones at the periphery of the eye than towards the centre/fovea. Part (a)(ii) proved to be very difficult to all but a small number of candidates.
- Q3** Q3, based on secondary succession, proved to be quite discriminating with a significant number of candidates obtaining 5–7 of the nine marks available; however, only a very small minority scored 8–9 marks in this question.
- (a)** Part (a) was disappointingly answered by many candidates, with a common answer being a good definition of a climax community, but crucially, without reference to the climate.
- (b)**
- (i)** Part (b)(i) was well done by many candidates with soil/nutrients already present at the start of the succession being the most common answer.
- (ii)** Part (b)(ii) proved to be much more challenging and discriminating. Many candidates simply repeated the information in the table without explaining the factors that caused the succession or the properties of the plants in the various stages that determined their position in the succession. There was evidence of many candidates providing a generic answer on succession without linking it closely to the succession in the question. A significant number of candidates referred to the pioneer species (herbs) modifying the soil and making it fertile enough to sustain herbs and trees. Being a secondary succession the soil was already formed and the sequence of succession was based on factors linked to the inherent properties of the species involved, e.g. the herbs (as often r-selected) being dominant in the early stages with the K-selected trees only reaching maturity and completing their life cycle after a longer time period. A majority of candidates did work out

the sequence of herbs having their dominant phase initially, followed by shrubs then the trees. There was also good understanding that the shrubs out-competed the herbs due to shading effects or being more able to obtain nutrients (similarly for the trees out-competing the shrubs).

(iii) Part (b)(iii) was quite well answered although only a minority scored both marks.

- Q4**
- (a)** Part (a) of this question about muscle was well done by many candidates. A majority of candidates recognised that the diagram represented myosin and actin in cross section and that the region where they exist together is the A-band. Part (a)(iii) was also well answered although many candidates unnecessarily made reference to troponin/tropomyosin; detail not required on the specification.
- (b)** Part (b) being less familiar and more applied proved to be much more discriminating.

Q5 This question on phytochrome was generally well done. A minority of candidates obtained the nine marks available, although a large majority scored between six and eight marks.

- (a)**
- (i)** In part (a)(i) a minority of candidates failed to obtain the mark as they defined a short day plant (SDP) rather than identifying the evidence from the graph indicating that a short day plant was the subject of the question.
- (ii)** Part (a)(ii) was also well done by most candidates although a number described how flowering can be induced in a SDP rather than how to postpone flowering.
- (b)**
- (i)** Part (b)(i) proved to be straightforward for most.
- (ii)** Part (b)(ii) proved to be discriminating with only a minority of candidates gaining all three marks. Most candidates who scored two marks failed to obtain the mark awarded for the levelling off of the graph – candidates who identified that the graph did level off usually were able to give a valid reason for this happening. A small number of candidates lost at least one mark through a lack of accuracy in their account, e.g. some candidates stated that was a positive correlation between the time the tip was on the coleoptile or the time that the agar was on the coleoptile (as opposed to time the tip was on the agar).
- (iii)** Part (b)(iii) was well done showing some good understanding by many candidates.

Q6 This question was a thirteen mark question covering aspects of the structure and physiology of the kidney. This question proved to be very discriminating with a majority of candidates scoring in the 5–10 mark range; only a small minority obtained full marks.

- (a)** Identifying the structures/regions of the kidney in the photographs proved challenging for many candidates with a significant number getting the cortex and medulla the wrong way round in part (a)(ii) – a significant number of candidates in this part also failed to distinguish between region and structure.

- (b) In part (b)(i) a large number of candidates answered that most water was reabsorbed by osmosis, but disappointingly, only a small minority answered that most water was reabsorbed in the proximal convoluted tubule.
- (c) In part (c) a majority of candidates showed good understanding of the role of ADH in the kidney; marks were often lost by not linking ADH concentration and action to the graph. Credit was given for the correct explanation of ADH function at any part of the graph. However, it was necessary for candidates to make explicit which stage of the graph was being referred to as opposed to a general account of the role of ADH. A significant minority of candidates lost marks for failing to use appropriate scientific terminology. Answers such as “drinking water causes the body to become more dilute” were not uncommon.
- (d) Candidate performance in part (d) was very disappointing. In part (d)(i) a very small minority of candidates answered clinistix correctly. Similarly, only a small number of candidates appreciated that the saturation of protein carriers was significant in the failure of the proximal tubule to reabsorb all the glucose in part (d)(ii).

Question part (d) was one of a number of synoptic topics on the paper and candidates should be aware that it is a requirement that synoptic questions appear on A2 papers. In A21 papers it is important to note that the synoptic questions can be from any part of the AS specification but they will always be set in context as part of an A21 topic.

Q7

This question, covering the phases of bacterial growth, also proved discriminating. Candidate performance was normally distributed around a modal mark of five of the ten marks available, with only a very small minority obtaining full marks.

- (a) The calculation in part (a) was well done by many candidates.
- (b) Part (b) proved more discriminating with many candidates obtaining two or three of the four marks. Most recognised the two exponential growth phases and further recognised that the intermediate lag phase between them was due to the time required for the conversion of maltose to glucose. However, many candidates gave very vague responses as an explanation for the initial lag phase. Answers such as “getting used to the environment” and “taking time to settle” were typical. A number of candidates failed to appreciate that the log phase growth was due to there being abundant glucose available or that resources were not limiting. The not uncommon explanation for the log phase “the bacteria were feeding on glucose” was not rewarded.
- (c) Part (c) proved very challenging for many candidates highlighting the problems many candidates have with practical techniques (particularly if set in an unfamiliar context) and synoptic questions. It was apparent that many candidates did not understand the general principles of a colorimeter, i.e. an instrument that can measure increasing or decreasing turbidity by changes in the transmission or absorption of light through a series of samples – marks were available for both recognising that higher numbers of bacteria will give lower % transmission values and also that the % transmission will change over time as bacterial numbers change. Many candidates framed answers around colour change in Benedict’s, suggesting that they were over influenced by the role of colour filters in many colorimeter practical settings/past colorimeter questions or even the term ‘colorimeter’ itself. The most able candidates recognised that bacterial numbers could be worked out by comparison with a

calibration curve linking % transmission/absorbance with known numbers of bacteria. Part (c)(ii) was well answered by a majority of candidates.

- Q8** Marks for this question involving familiar concepts set in the unfamiliar context of the ecology of the holly leaf miner and its common parasite were also normally distributed across the candidature. Candidates who performed less well in the paper as a whole tended to do very poorly in this question.
- (a)** Part (a) proved straightforward for many candidates but a significant number did not appreciate that this was an example of an inverted pyramid of numbers. Additionally, many candidates failed to appreciate that the holly leaf miner and adult are actually the same organism and therefore produced pyramids that included both larvae and adults as separate organisms.
 - (b)** Part (b) – the definition of a parasite in the context of the question – was well answered by many candidates although a disappointing number failed to achieve this mark.
 - (c)& (d)** Part (c) requiring some understanding of sampling technique in an unfamiliar setting proved too difficult for many candidates, with many providing answers involving a capture-recapture technique. The more able candidates recognised that this question was in part a comprehension question and that they had to use the information provided in the stem of the question to describe how they could identify holly leaf miner death (or survival) at the various stages listed in the table. Many candidates showed good understanding when answering parts (c)(ii), (iii) and (d)(i). Part (d)(ii) discriminated well and vague answers involving general damage to the habitat were not rewarded. References to pesticides damaging other plants also failed to gain credit. While accepting that this was a demanding question that tested all candidates, it is very pleasing to note that a small number of very able candidates did show the high level of biological understanding required to obtain full marks, an excellent achievement by all concerned.

Section B

The essay involved an understanding of the link between human activity and water pollution and the strategies that could be used to minimise water pollution. Many candidates performed very well in this question and it is very pleasing to note the high level of understanding of the link between the appropriacy of agricultural practice and water quality in a Northern Ireland setting. A significant number of candidates did obtain full marks but there was, nonetheless, a good spread of marks. Not surprisingly, most candidates did tend to build their answers around problems caused by eutrophication arising from the leaching of artificial fertiliser into waterways. However, a significant number of candidates (including some very able candidates) failed to obtain full marks through not providing the breadth of answer required to achieve full marks. Typically, marks were lost through failing to refer to the role acid rain plays in the contamination of waterways or other aspects of water pollution that are specifically referred to in the specification, e.g. the harm that can be caused by toxic residues of veterinary medicine entering the waterways.

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