



## External Assessment Report 2013

Subject(s)	Biology
Level(s)	Advanced Higher (Revised)

The statistics used in this report are pre-appeal.

This report provides information on the performance of candidates which it is hoped will be useful to teachers/lecturers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding. It would be helpful to read this report in conjunction with the published question papers and marking instructions for the examination.

# Comments on candidate performance

## General comments

Only one centre presented candidates for the Advanced Higher Biology (Revised) course this year; 12 candidates in total. The decision to take on the revised course is admirable given that there is no library of past SQA question papers to draw on for judging standards or to rehearse with.

In the revised course there are three mandatory Units; there are no optional Units. The question paper component has a total of 90 marks. There is also an Investigation component worth 25 marks; the total mark for the external assessment is 115.

The question paper comprises a Section A of 25 objective test items, and a Section B worth 65 marks in which there is a variety of question styles. The long extended response (essay) is worth 10 marks, and there may be other shorter pieces of extended writing worth up to 5 marks.

It may not be possible to provide relevant general remarks on errors and misconceptions for this course this year in the way that can be done for the non-revised Advanced Higher Biology question paper. Performance analysis for individual questions will be unreliable because of the small sample size. There are also challenges in judging performance when there is no obvious way to know where this candidate cohort fits in relation to the general range of candidates who were presented for the unrevised Advanced Higher Biology course.

There are, however, some indicators for comparison. Overall, the average prior attainment (at Higher level) of the candidates who were presented for the revised course matched that for the cohort who were presented for the non-revised course. In addition, average outcomes for each component of the two courses also matched, to within half a mark.

## Areas in which candidates performed well

Unit 3 questions were relatively well done (Q5 and part of Q7).

- ◆ Question 2a)i) and ii): Calculations were done well by most candidates.
- ◆ Question 4c): Most candidates described the data correctly.
- ◆ Question 5a), b) and c): Most candidates scored well in these items. The method is commonly used in hospitals as a quick way to determine sensitivity or resistance of bacteria to different antibiotics.
- ◆ Question 6a), b) and d): Almost all the candidates could identify the role of caspases, and more than half of them understood why cell death must be controlled and why Bcl-2 is implicated in tumour formation.
- ◆ Question 7a), b): Most of the candidates did well with the insulin/GLUT 4 recruitment story, and many saw the link between adiponectin and diabetes.
- ◆ Question 8 was well done by most candidates, possibly because they had already met the ideas in their Higher work. For future groups, this theme may not be a recap.

- ◆ Question 9: All candidates knew the term 'sexual dimorphism'. The highest score for the question was only 4/7, however.
- ◆ Question 10a)ii),b): Part a)ii) is looking for the story from current Higher about resistance arising from mutation and increasing in frequency. Candidates picked up half the marks here. In part b) just over half scored these marks.
- ◆ Question 11: Choice B was done relatively well (average 6.4/10). Half of the candidates picked this option.

## Areas which candidates found demanding

Given that the revised course has a taught Unit on scientific method, it was surprising that Investigations turned out very like those normally seen at Advanced Higher level. The range of marks was fairly typical. Candidates did have more awareness of the concepts from Unit 3 when writing about planning or principles. However, the types of topic investigated and the pitfalls were the ones Markers see routinely. There is further comment in the final section of this report.

Question 2b), c): Only a few candidates could explain the purification methods. Items were good discriminators.

Question 3b), d): Part b) Most candidates did not identify structural level of the protein as tertiary, even though they were told it was a protein *molecule* and quaternary structure was described and shown. In part d) no candidates scored this mark.

Question 4a), b): Understanding of enzyme mechanism weak. Able candidates included more information to answer the question fully.

Question 5d): No candidate considered that evaporation of water from the medium would reduce the agar thickness. This would affect the volume below the disc into which the substance initially dissolves, and thus affect its concentration gradient and rate of diffusion.

The data for this question come from a 1971 article pointing out pitfalls in the method (Davis<sup>1</sup>). The protocol, which is essentially qualitative, is commonly used inappropriately in school investigations to quantify bacterial inhibition by disparate substances. The original work (Bauer et al, 1966<sup>2</sup>) points out the strict standardisation against dilution plates required for particular combinations of antibiotic and microbe to use inhibition zones for screening.

Question 6c)i) and ii): Some candidates scored marks here but most did not recognise the relatively easy ideas from the Arrangements document p21.

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1 Davis, WW and Stout, TR (1971); *Disc Plate Method of Microbiological Antibiotic Assay Part 1: Factors influencing variability and error*. Applied Microbiology, Oct. 1971, vol 22, No4, p. 659-665

2 Bauer AW, Kirby WMM, Sherris JC and Turck M (1966); *Antibiotic Susceptibility Testing by a Standardized Single Disk Method*. American Journal of Clinical Pathology, 45:493-496.  
<http://202.114.65.51/fzjx/wsw/newindex/wswfzjs/pdf/105bauer.pdf>

Question 7c), d) is testing Unit 3 content in the adiponectin context; c) is asking about the error terms and if upper and lower confidence limits overlap. Only 25% of candidates scored here. Part d) is about Scientific Ethics in human studies (Arrangements document p40), and Sampling (p44).

Question 9b), c): Part b) Less than half the candidates scored here; the careful ones noted that it was the number of *species* that was increasing. Part c) Honest signalling (p32) was not well done; the key here is that females are selecting males on the iridescence of plumage, which is a direct indication of male health.

Question 10a): Only a few candidates put both graphs together to show that the parasitoid markedly affected the population of flies in cage A but not in B where the flies had had three years to adapt.

Question 11: The average score for choice A was 3.8/10. The detail required is on p34 of the Arrangements document.

## **Advice to centres for preparation of future candidates**

### **General**

Extended response items (essays and mini essays) have high discrimination values; the candidates who do well in these also tend to do well in the other questions in the question paper. These candidates are well prepared, have good recall, and they are able to express ideas correctly and clearly. Approximately 20% of the revised question paper could use this style of question.

It may be valuable for candidates to rehearse extended responses as short blocks worth five marks. Generally for essays there will be about 8 points in a marking instruction for a 5 mark theme, and the marking instruction would consist of syllabus content statements set out like those in the official marking instructions for this question paper. Pairs of these can be combined for a long essay.

Candidates can lose marks because clarity is missing, either in basic understanding of the biology or in expressing thoughts as text. They can also lose marks by not reading correctly: questions are worded very precisely and they need to be read that way. They need to recognise what is given; and assume all information provided has a purpose. Terms or descriptions used in the stem of a question are not normally going to be part of the answer; stress that, quite commonly, content in the stem will have been given to push for a more thoughtful answer, not to make it easier.

### **Investigations**

Marking instructions for the Investigation component are available on SQA's website, and centres can mentor candidates and initially supervise the experimental design aspects of the work via the lab record. Despite this, many Investigations score badly.

Some Investigations are too simple, and are little more than a practical from a lower level. Some have inappropriate methods for the idea being tested; some have uncontrolled

variables or lack a valid control. Others can be attempting too much, having several inputs and several outcomes to monitor. The former have too little of value to discuss; the latter have overwhelming amounts of data that can't be processed sensibly. Many are designed badly.

It is important to keep focused on what the investigation is — an early attempt by candidates to follow the 'scientific method'. They are attempting to design an experiment that will be an honest attempt to refute a hypothesis. If they have a valid design and reliable data, candidates will have a good deal of information to discuss at the end of the Report (Section 5 of the marking instructions).

In the question paper, data-handling items are normally based on published scientific papers. Candidates recognise that, in these items, error bars show there was measurement variance between samples used in the study and that these reliability measures for the data underpin the validity of conclusions. Markers look for this same insight when marking Investigations.

Candidates could possibly attain better scores by setting up two or more independent runs of the whole plan. Sub-samples from within each run will usually vary and, with biological material, there will be variation between independent runs. All this measurement variance has to be documented and explained, and its impact on conclusions weighed up. It can be more valuable and more economical to have more repeats than more variables.

SSERC will be publishing a resource to support the Unit, *Investigative Biology*, elaborating on the content of the Unit and linking it to the marking instructions.

## Statistical information: update on Courses

Number of resulted entries in 2012	-
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Number of resulted entries in 2013	12
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## Statistical information: Performance of candidates

### Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark 115				
A	25.0%	25.0%	3	78
B	25.0%	50.0%	3	66
C	41.7%	91.7%	5	55
D	8.3%	100.0%	1	49
No award	0.0%	100.0%	0	-

## General commentary on grade boundaries

- ◆ While SQA aims to set examinations and create marking instructions which will allow a competent candidate to score a minimum of 50% of the available marks (the notional C boundary) and a well prepared, very competent candidate to score at least 70% of the available marks (the notional A boundary), it is very challenging to get the standard on target every year, in every subject at every level.
- ◆ Each year, SQA therefore holds a grade boundary meeting for each subject at each level where it brings together all the information available (statistical and judgemental). The Principal Assessor and SQA Qualifications Manager meet with the relevant SQA Business Manager and Statistician to discuss the evidence and make decisions. The meetings are chaired by members of the management team at SQA.
- ◆ The grade boundaries can be adjusted downwards if there is evidence that the exam is more challenging than usual, allowing the pass rate to be unaffected by this circumstance.
- ◆ The grade boundaries can be adjusted upwards if there is evidence that the exam is less challenging than usual, allowing the pass rate to be unaffected by this circumstance.
- ◆ Where standards are comparable to previous years, similar grade boundaries are maintained.
- ◆ An exam paper at a particular level in a subject in one year tends to have a marginally different set of grade boundaries from exam papers in that subject at that level in other years. This is because the particular questions, and the mix of questions, are different. This is also the case for exams set in centres. If SQA has already altered a boundary in a particular year in, say, Higher Chemistry, this does not mean that centres should necessarily alter boundaries in their prelim exam in Higher Chemistry. The two are not that closely related, as they do not contain identical questions.
- ◆ SQA's main aim is to be fair to candidates across all subjects and all levels and maintain comparable standards across the years, even as arrangements evolve and change.