External Assessment Report 2015

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

The statistics used in this report are prior to the outcome of any Post Results Services requests.

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

In the Advanced Higher Biology (Revised) Course there are three mandatory units. There are no optional units. The revised question paper component has a total of 90 marks (10 less than the traditional paper); there is also an Investigation component worth 25 marks, making the total mark 115 for the external assessment.

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.

This year there were 22 entries spread over four centres; for one centre, this represents its third presentation. The average ability of candidates moving on from Higher is similar to that for the traditional course. The average score was 66/115, which is a decrease of 6% from last year.

The Investigation component scores (component 3) were slightly higher than last year's at 15.1/25, two marks higher than the mean for the traditional course; hopefully this improvement was as a result of teaching the principles of investigation in Unit 3. Candidates scored well in Component 1, multiple choice questions averaging 19/25, a score that matches the performance in the previous two years and of candidates in the traditional course. Candidate performance in Component 2, thewritten exam, was 31.7/65; a marked decrease in overall performance compared to last year.

Due to the small sample size for this course, it is not possible to provide relevant general remarks on errors and misconceptions in the way that can be done for the traditional question paper. Performance analysis for individual assessment items will also be unreliable, and there is no way to be certain how well candidates in this external assessment compare with last year's, or where this cohort of candidates fits in relation to the general range of the larger cohort who were presented for the traditional course.

Areas in which candidates performed well or found demanding

In all questions, there were always some candidates who scored almost full marks. Often a candidate performed well in some contexts then not so well for others.

Section B

Question 1: This question, set in the context of how guard cells open in response to a burst of blue light, sampled across Units 1 and 3. [Unit 3 = (b)(ii), (c)(i) & (ii), (d)] Candidates had to work out the consequences of blue light striking the flavin photoreceptor of phototropin and activating a kinase component. Evidence shows that phototropin acts like a switch for the active transport of H^+ and the consequent voltage change opens K^+ channels to let K^+ in. Osmosis through

guard cell aquaporins lets water move inwards quickly in response.

Some candidates scored almost full marks, and the majority scored over half. Items (e) and (f) were the most discriminating, as intended.

Question 2: Most candidates performed well in this question, approximately half scoring full marks. A few were caught out by the need to scale up from monthly to annual incidence of diarrhoea.

Question 3: Many candidates performed well with the sex-linked genetics problem but did not understand the need for X inactivation and that, because it occurs at random in embryos, the dominant allele will be expressed in some cells but not others in the heterozygote.

The term *heterogametic* for item (c) did not appear often.

Question 4: This question was not generally well done; only two candidates scored more than half marks.

Question 5: Most candidates performed well in this question; only 4 candidates scored less than 4/7. Parasitism was the context but several of the items were based on Unit 3 relating aspects of experimentation to drug trials.

Question 6: Most candidates were unfamiliar with this mechanism in the detail tested.

Reversible phosphate binding refers to the kinase/phosphatase notes. There are examples of this throughout the syllabus, eg in sodium/potassium pumps and control of cell cycle.

'Control of conformation' would be better as a separate entry next to the notes on myosin: it is not intended to be another example of Pi transfer — it is an example of how controlling conformation change brings about muscle contraction. ATPase hydrolyses ATP; in this example, when Pi is expelled from the protein there is a conformation change.

In the sliding filament mechanism, at the point shown on the diagram, binding of ATP has just released myosin heads from their attachment to actin (filament Y). The head has ATPase activity and it immediately sheds a Pi to leave ADP tightly bound. The presence of ADP causes a conformational change in the head so that it reaches forward ready to attach again to actin.

(If Ca^{2+} is present from an action potential ...) When the head attaches to actin ADP is released from the head; the contact remains fixed and the conformation reverses. Since the myosin and actin are still attached, the shape change is the 'power stroke' to pull (slide) the actin filament (to the left on the diagram). The attachment is released when another ATP binds to the head.

Question 7: This question is directed at section (b)(iv) in the syllabus. Item (b) was answered well, but many candidates did not manage to explain how induced fit works (a) or what co-operativity looks like in enzymes. The graph shape for enzyme B matches the saturation curve for oxygen uptake by haemoglobin and could be explained in the same way. (Mean score 1.0 /4)

Question 8: Many candidates did well with the problem solving item (a) and knew the role of Na/KATPase in establishing membrane potential. Candidates were generally not clear about nerve transmission.

Question 9: Approximately half of the candidates performed weII in this question (score = 4+/7). Item (a) is based on the taxonomy section in Field Techniques of Unit 2 (Content 1(c), p24).

Caspases are proteases that activate other proteases and these activate DNAses. Only the proteases are 'collectively known as caspases'.

A surprising number of candidates managed to answer part (d) correctly in what was quite a challenging theme to meet towards the end of their efforts.

Question 10: The two essays were chosen by equal numbers of candidates. Scores in each ranges from 1 to 9 out of 10. Essay B on evolution scored slightly better.

Advice to centres for preparation of future candidates

The following comments are largely the same as those in the corresponding section of the External Assessment Report for the traditional course. They are not intended to be specific feedback to the centres that opted for the revised course this year.

Although this is the final year of this course, there are general matters that will continue to affect candidate performance in the new Advanced Higher Biology Course.

Teachers/lecturers need to be up to date with their subject knowledge in all the syllabus areas in the new courses. For some who did not teach this Advanced Higher, there will be topics to master for Higher or the levels below, displaced from the outgoing syllabus, and there will be new biology content where little has been derived from outgoing Highers.

In large part, the content of the Revised will form the content of the new Advanced Higher Biology arrangements. The revised course ran parallel to the traditional course for the last three years therefore there are SQA past question papers to help gauge the scope and depth of concepts. These papers are available on the SQA website.

An Investigation component is part of the new Advanced Higher Biology Course where it forms part of the assessment of Unit 3, a full Unit devoted to the understanding of Investigative Biology. The externally assessed project report has a different marking scheme to the traditional and revised investigation report.

The published SQA past question papers contain questions based on this Unit; these will be illustrative for how the content might be assessed. SSERC has also published a monograph dealing with the new Advanced Higher Biology material; it is available to download via the Resources page on their website. A further SSERC publication to support investigation planning, data handling and statistics has also been published.

For centres, the issues associated with designing and carrying out investigations will remain the same; these have been enumerated regularly in previous External Assessment Reports over the years; however a few key reminders are given below.

Plan for safety. In some cases, candidates are submitting some very dubious work; eg where they have variously cultured (and sub-cultured) samples from soil, skin, sink, toilets, rivers presumed to be affected by sewage outfall, and 'seeded' material left outdoors for days. Sometimes culturing has been at 37°C.

Centres must comply with local authority health and safety requirements as they apply to senior candidate investigations. SSERC's codes of practice for Scottish schools and colleges: *Safety in Microbiology* and *Materials of Living Origin* is a useful document to refer to.

Know what is being assessed. The purpose of the Investigation component has been to develop investigation skills by obliging candidates to carry out a project. The assessment element has looked for and evaluated the *investigative process* in the work, to see if candidates have understood the mechanics of designing experiments that might lead to a valid conclusion, and to see if they can make sense of the data they collect.

Candidates can be aware of the parts of the process better if they limit the number of inputs they vary, and limit the outcomes they measure. Badly designed, an investigation can generate too little data to score much, or so much data that it is overwhelming. It is a more important use of time to repeat the whole of a simpler piece of work to have replicates to compare than to have single sets of data on a wide array of measures.

A sound protocol with controls, reasonable sample sizes and independent replication will reveal variability in results. Analysis of the data will show if the variability is caused by erratic lab practice, intrinsic variation in material or the treatments that have been planned.

Question Paper: Read questions carefully twice, underlining key words if necessary. In numerical problems, show the working. Units are normally required with data.

In longer data handling questions, the first items will usually help to focus on the main theme. Follow the instructions to refer to specific tables or figures and don't stray beyond these; other material will be questioned later.

It is important to remember any new information given in question stems; it may be providing key information or setting up an idea slightly beyond what has already been provided. Repeating details from the stem will not gain any credit in an answer.

Statistical information: update on Courses

Number of resulted entries in 2014	15

Number of resulted entries in 2015	22

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	27.3%	27.3%	6	77
B	22.7%	50.0%	5	67
C	27.3%	77.3%	6	57
D	9.1%	86.4%	2	52
No award	13.6%	-	3	-

For this Course, the intention was to set an assessment with grade boundaries at the notional values of 50% for a Grade C and 70% for a Grade A. The Course assessment proved to be more difficult than intended. This only affected Grade A candidates. The grade boundaries were decreased by 3 marks for Upper A and Grade A to reflect this.

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.