



Review of Standards in GCE A level Biology

2003 and 2008



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Contents

Findings	3
Section 1: Introduction.....	5
Context.....	5
Methodology	5
Provision of assessment materials and student work	6
The review team.....	6
Analysis of the specifications and assessment materials	7
Analysis of student performance	7
Data analysis.....	8
Section 2: Subject demand in GCE A level Biology.....	9
Overview	9
Findings	10
Assessment objectives	10
Specification content	10
Schemes of assessment	10
Options.....	10
Question papers and mark schemes.....	11
Coursework	13
Section 3: Standards of performance	15
Overview	15
Process	15
Interpreting the graphs	15
Findings	15

Performance at the GCE AS grade-A boundary	15
Performance at the GCE A2 grade-A boundary	17
Performance at the GCE AS grade-E boundary	18
Performance at the GCE A2 grade-E boundary	19
Conclusions	20
Appendix A: Provision of assessment materials and student work at GCSE and GCE levels for Ofqual's archive (annual inclusion and standards reviews)	21
Section 1: Specification of requirements	21
Section 2: Student work	22
Appendix B: Schemes of assessment	24
Appendix C: A level specifications reviewed	26
Appendix D: A level scripts reviewed	27
Appendix E: Availability of specification materials for the purposes of this review....	28
Appendix F: Student achievement by grade	29
Appendix G: Measure, standard error (SE) and infit values of the ranked scripts	30
Appendix H: Review team	36
Appendix I: Assessment objectives	37
AO1 Knowledge with understanding	37
AO2 Application of knowledge and understanding, analysis and synthesis and evaluation	37
AO3 Experiment and investigation	37
AO4 Synthesis of knowledge, understanding and skills	38

Executive summary

The Office of Qualifications and Examinations Regulation (Ofqual) undertakes a rolling programme of reviews across high-profile GCSE and GCE A level subjects to monitor whether standards in assessment and student performance have been maintained over time.

This report details the findings for GCE A level Biology in the years 2003 and 2008. The previous review for this subject compared the years 1999 and 2003, and the findings were published in a report in 2005 which is available on our website at http://www.ofqual.gov.uk/files/12891_biologyreport.pdf.

The study upon which this report is based compared subject specifications, assessment materials and student work from the five organisations awarding this qualification in the years being reviewed, collecting the views of a number of subject specialists. The awarding organisations involved were: AQA, CCEA, Edexcel, OCR and WJEC.

Findings

The subject criteria were common to both the years reviewed, as were the specifications, with 2003 being the second year in which these specifications were awarded and 2008 the seventh. Because of this, any changes over time were due to differences in the questions being asked in assessments. Reviewers identified the following differences:

- OCR offered a higher proportion of options within the qualification than the other awarding organisations, and reviewers found that there was a lack of parity between these options in terms of the content covered and the academic demand of the assessment, both within the specification and within other awarding organisations.
- WJEC's question papers had a high percentage of short-answer, structured questions, which reduced the amount of material to read and process. Reviewers found that this made these papers less demanding but overall the papers were found to be sufficiently demanding for this level of qualification.

- Reviewers found that CCEA's question papers were insufficiently demanding meet the minimum level expected at the boundary of grades E and U, and did not offer sufficient opportunity for more able students to demonstrate the knowledge and skills required to secure that grade. In summary, this was due to:
 - the proportion of questions set on straightforward tasks not allowing for full development of the most complex aspects of assessment objective 2, so that potential grade-A students did not have sufficient opportunity to demonstrate their higher skills, including synthesis and evaluation
 - an over-generous mark scheme for the free-prose questions effectively decreasing the academic demand of those questions
 - the coursework element being less complex than that offered by other awarding organisations
 - CCEA's student performance at both grade boundaries examined, and in both years reviewed, being also consistently lower than that reviewed from other awarding organisations.

Section 1: Introduction

Context

We regularly review qualifications in different years to check that standards are maintained over time.

These reviews inform future developments in qualification and subject criteria and help us to compare standards across awarding organisations. In our reviews we:

- analyse the nature of the requirements different assessments make on students
- compare the levels of performance required for a particular grade in different assessments
- consider how these two elements relate to each other.

Between 2003 and 2008 there was a marked increase in the number of students that took the GCE A level Biology specifications being reviewed: 36,117 students in 2003 and 43,602 in 2008. A detailed breakdown of student-entry numbers and cumulative percentage pass rates can be found in [Appendix F](#).

Our immediate predecessor, the Qualifications and Curriculum Authority (QCA), most recently conducted a standards review in GCE A level Biology, using materials from 1999 and 2003. The findings were published in a report in 2005, which is available on our website at http://www.ofqual.gov.uk/files/12891_biologyreport.pdf .

Methodology

Standards reviews examine different specifications within a qualification, the associated assessment instruments and samples of student work, by collating and analysing the views of a number of subject specialists. The following sections of this report detail the process of collecting and processing this information. In these reviews, we compare how demanding a specification is against all of the other specifications under review and includes consideration of:

- specification-level factors such as assessment objectives, content and structure
- assessment-level factors such as what content is assessed, the weighting of each component and how the assessments are marked
- student performance-level factors, including how the students responded to the assessments and the grades they received as a result.

How demanding an assessment of a qualification is can be defined in a variety of ways and is linked to the purpose of the qualification. It is related to:

- the amount and type of subject knowledge required to be assimilated
- the complexity or number of processes required of the students, the extent to which the students have to generate responses to questions from their own knowledge, or the extent to which resources are provided
- the level of abstract thinking involved
- the extent to which the students must devise a strategy for responding to the questions.

Provision of assessment materials and student work

Details of our requirements for the provision of assessment materials and student work for review are given in [Appendix A](#) and, in summary, include:

- the current specification
- all associated question papers
- final mark schemes
- reports from the examiners, and grade boundaries (overall and by unit, and both raw and scaled)
- mark distributions, grade descriptors and assessment grids
- any other information that was routinely supplied to centres
- all the assessment work carried out by a sample of students whose final grade lay at or near the judgemental grade boundaries for the qualification being analysed.

The comparable materials that were collected and retained for the previous review were retrieved from our archive of assessment materials and student work.

Full details of the materials supplied by awarding organisations can be found in [Appendix C](#) and [Appendix D](#).

The review team

We contracted 18 experts in GCE A level Biology to undertake the review. These reviewers were sourced through:

- a subject-expert recruitment exercise carried out by us in November 2010, advertised via the Times Educational Supplement and our website and newsletter
- nominations made by the regulators in Wales and Northern Ireland
- nominations made by awarding organisations involved in the review
- nominations made by subject associations and other learned organisations invited to participate in the review.

A full list of reviewers can be found in [Appendix H](#).

We contracted a lead reviewer, specification reviewers and script reviewers. (All nominees from awarding organisations and subject associations were script reviewers.)

Analysis of the specifications and assessment materials

The lead reviewer and specification reviewers (specification review team) analysed the awarding organisations' materials, using a series of forms which can be found via the comparability page on our website at www.ofqual.gov.uk/research-and-statistics/research-reports/92-articles/23-comparability.

These analyses are designed to describe how demanding the specification is. Each reviewer analysed a subset of the specifications available, so that there were at least three different views on each specification. The lead reviewer then produced a report which brought together the views of the reviewers on each of the awarding organisations' specifications. The specification review team had the opportunity to discuss the lead reviewer's conclusions at a follow-up meeting. The findings are presented in Section 2 of this report.

Analysis of student performance

To assess student performance, all reviewers were brought together for a two-day meeting to analyse students' scripts (pieces of student work supplied by the awarding organisations). This process is referred to as a script review. The meeting started with a briefing session to make sure that all the reviewers had a common understanding of the methodology and the judgement criteria.

The scripts were organised into packs for consideration during the review. Packs were organised by grade (Only grade boundaries A/B and E/U were analysed, as grades B, C and D are calculated arithmetically after grade-boundary marks for grades A and E have been set during the awarding process carried out by the awarding organisations.)

As far as was possible, given the collection of scripts available, packs contained 12 scripts at the same grade, with at least one script from each awarding organisation from 2003 and 2008 (the remaining two scripts were selected at random).

Reviewers were then asked to rank the 12 scripts in each pack, from best to worst, on a data-entry sheet and to make comments on the scripts as necessary. Each reviewer completed a maximum of 17 sessions over the two-day script review.

During the two-day meeting there were plenary sessions for reviewers to discuss the script review process and the quality of the scripts being analysed.

Data analysis

We use a software package called FACETS to analyse the results from data-entry sheets produced during the script review. FACETS uses a Rasch model (often classified under item response theory) to convert the qualitative ranking decisions made by reviewers into a single list that reflects the probable overall order of the sets of student work, from best to worst.

We use this list, alongside the qualitative comments made during the script review and findings from the specification review, to inform Section 3 of this report.

Section 2: Subject demand in GCE A level Biology

Overview

Specification reviewers considered the amount and type of knowledge about biology required by each awarding organisation's specifications. They did this by analysing specification documents, reports from the examiners and question papers with associated mark schemes from each of the awarding organisations from 2003 and 2008. Details of the specifications included in the review are given in [Appendix C](#).

As the specifications used in both 2003 and 2008 were the same, there were no changes in what was included in the qualifications in terms of content or style of assessment. So any differences over time were due to changes within the assessment themselves. From these comparisons the following points emerged.

- In terms of the time allowed by OCR for students to complete their papers, reviewers judged that it was tighter than that of other awarding organisations and was sufficient to make OCR's qualification more demanding than those of other awarding organisations, particularly at A2. However, the time allowed was within an acceptable range.
- There was a lack of parity between the options offered by OCR, which could result in some students undertaking more demanding qualifications than others within the same specification.
- Questions set in CCEA papers did not allow for full development of the most complex aspects of assessment objective 2 and this meant that potential grade-A students did not have sufficient opportunity to demonstrate their higher skills, including synthesis and evaluation.
- WJEC's high proportion of short-answer, structured questions and the reduced amount of material to read and process made the papers less demanding than those of other awarding organisations.
- CCEA's over-generous mark scheme for the free-prose questions effectively made those questions less demanding.
- CCEA's less complex coursework element was less demanding than that of the other awarding organisations.

Findings

Assessment objectives

Assessment objectives, and the balance and weightings of knowledge, skills and understanding, were the same in 2003 and 2008, as in both years the qualifications were based on the same subject criteria. All awarding organisations had clearly defined the assessment objectives in the specification and none had altered its assessment objectives between these two years. Coverage for all awarding organisations was broadly in line with the weightings given in the specification documents. Some awarding organisations gave greater emphasis to the less difficult assessment objectives, but this was always within acceptable ranges.

Specification content

Reviewers found little change in the nature and range of topics covered by the specifications in 2003 and 2008. The majority of awarding organisations did not alter their list of topics. The only exception was Edexcel, which made one minor change. This change had no impact on how demanding the qualification was.

The range of topics covered by all awarding organisations was broad, and reviewers judged that generally there was a good balance between topics. All the topic areas considered essential for GCE A level Biology were covered in the specification, although there was some question about whether some options allowed for satisfactory coverage – see Options below. Reviewers felt that CCEA placed a larger reliance than other awarding organisations on very traditional topics, which are considered less relevant in modern biology.

Schemes of assessment

There were a few minor changes to the schemes of assessment between 2003 and 2008. A table detailing examination structures and timings can be found in [Appendix B](#). Reviewers judged that any amendments made to the length of examinations did not have any impact on how demanding the papers were in 2003 and 2008.

In both 2003 and 2008 reviewers judged that the time allowed for OCR's papers was tighter than that of the other awarding organisations' papers, particularly in view of the quantity of material to be assimilated and the fairly lengthy reading requirement. This was particularly true at A2, and reviewers judged that this was sufficient to increase the demand of OCR's qualification but within what is reasonable.

Options

Each awarding organisation offered the same number of optional topics in 2003 and in 2008. No awarding organisations offered any options at AS. However, at A2 the availability or the number of options varied widely between awarding organisations.

CCEA and WJEC offered no optional topics or units and all examination papers had to be taken by all students.

Variations in the amount of topics that were allowed to be optional were permitted by the subject criteria. Reviewers judged that both AQA and Edexcel, by making a substantial portion of the content compulsory, had ensured that all essential elements of the specification content were covered. They judged, however, that the more substantial option choice presented by OCR could have the effect of distorting the range of topics studied and assessed. For example, students might miss out on topics in environmental biology (ecological techniques, pollution, conservation) or microbiology and biotechnology (aspects of gene technology), depending on which options they select. Reviewers considered that the options offered meant that some components of biology that were compulsory in other awarding organisations' specifications existed only as optional material in OCR's specifications.

Reviewers judged that, in general, the options offered within awarding organisations' specifications were equally demanding. Whilst reviewers considered that, in AQA's specification Units 6 and 7 offered more opportunities for practical work than Unit 8, they judged that the content of the three options was nevertheless equally demanding. Similarly with Edexcel's options; although it was considered that option A contained marginally more difficult concepts than options B or C. The parity of options offered by OCR was questioned, and reviewers thought that options 2 and 5 in particular would be more demanding for students, and therefore that the selection of option route might alter the demand of the overall GCE A level. The options in A2 were also thought to create an imbalance and this in turn might have had an effect on how demanding the A level is.

All awarding organisations also offered identical choice within their papers between 2003 and 2008, although the number of options varied between awarding organisations. OCR and CCEA offered no optional routes within papers. At A2, Edexcel and AQA required students to select an essay title in the synoptic paper from a choice of two. At AS, WJEC asked students to select an essay title in Unit 1 from a choice of two, and at A2 Units 4 and 5 offered students a choice of two essay questions from which they had to choose one. Reviewers judged that these option choices had no detrimental effect on the coverage of the specification

Question papers and mark schemes

There was little difference in the types of question set between 2003 and 2008. AQA, CCEA and WJEC did not alter the types of question asked nor the mark schemes.

At OCR some minor differences were noted. In paper 2802 in 2008, there was a greater emphasis on questions requiring interpretation of data and evaluation, and less scaffolding for students than in the paper in 2003. On the other hand, A2 examination papers in 2003 contained a larger quantity of text and data which had to

be assimilated before questions could be answered. However, reviewers concluded that there was no change in how demanding the papers were overall.

Reviewers considered that AQA and OCR had a sufficient range of question types to enable lower-attaining students to demonstrate what they could do. They also offered opportunities for higher-attaining students to show their knowledge and understanding of biology. While Edexcel did not give higher-attaining students the opportunity to demonstrate their ability in Units 1 and 2 at AS, the opportunity was given in Unit 3.

It was concluded that CCEA tended to set questions on the more straightforward tasks; they thought that the nature of the material used did not allow for full development of the most complex aspects of assessment objective 2. Question sub-parts were short, attracting only 1 or 2 marks, and free-prose questions had substantial structure or “scaffolding”. For these reasons, reviewers concluded that potential grade-A students had opportunities to show the breadth and depth of their knowledge but not to demonstrate sufficiently their higher skills, including synthesis and evaluation.

Similarly, reviewers observed that WJEC’s papers, both at AS and at A2, had a large proportion of short-answer, structured questions. At A2 the amount of materials that WJEC students needed to read and process was less than for other awarding organisations, but it was within acceptable limits. Reviewers also considered that these examination papers were less likely to present unfamiliar or unseen experiments or scenarios than those of other awarding organisations, and this might have made these examination papers less demanding than those of other awarding organisations.

Reviewers evaluated all awarding organisations’ question papers and mark schemes to determine whether there was clear progression from AS to A2. Their conclusion was that all awarding organisations showed clear progression. OCR in particular had a noticeable increase in novel material and questions that expected students to synthesise their responses from different sources of information. Reviewers also noted that all awarding organisations showed progression within AS and A2, both between examination papers and within examination papers. It was because of this practice that the examination papers were suitable for both lower-attaining and higher-attaining students.

Reviewers felt that the questions in all the papers seen were clear and easy to follow, with appropriate phrasing. The layout of examination papers was generally helpful, although reviewers noted that on the longer questions, OCR’s examination papers might hinder students who would have to scan more than one page to find data, for example.

Mark schemes were not available at the time of review for all awarding organisations. Reviewers agreed that the mark schemes they saw were clear and unambiguous. They concluded that CCEA's mark scheme for the free-prose questions – which provided long lists of alternative answers for which points could be awarded – was over-generous, effectively making these questions less demanding.

Coursework

There was variation between the GCE A level coursework assessments across awarding organisations, though very little between 2003 and 2008 within awarding organisations.

Awarding organisation	Skill areas	Marks
AQA	planning implementation analysis evaluation synthesis of skills and concepts	0-8 mark scale for 4 skill areas 0-6 mark scale for "evaluating evidence and procedures"
CCEA	AS: 4 skill areas (implementing, recording and communicating, interpretation, evaluation of experimental design). A2: 3 skill areas (planning, implementing and recording, analysis and interpretation).	0-40 marks overall 0-40 marks overall
Edexcel	T1: planning implementation analysis evaluation	0-32 marks overall

	T2: individual study	0-32 marks overall
OCR	planning analysis implementation evaluation	0-8 mark scale for planning analysing 0-7 mark scale for implementing and evaluating
WJEC	Directed and timed activities provided by WJEC	105 mark total Up to six additional teacher- assessed marks for practical skills.

The coursework units provided by awarding organisations were considered to be appropriate. Edexcel's scheme of assessment allowed for an alternative written examination paper, available at A2. Reviewers considered that this was a valid attempt to cover all the same skills – except for direct assessment of practical work – but it would be difficult for a student to score high marks without appropriate experience of practical work.

Reviewers thought, however, that CCEA's coursework element did not differentiate between those that performed each one-mark task well and those that only just achieved a mark, meaning that most candidates scored highly. The coursework element was too basic, with a limited range of tasks and skills, and made fewer demands on students than the coursework elements of other awarding organisations.

Section 3: Standards of performance

Overview

Process

Reviewers considered students' work from all of the awarding organisations in 2003 and 2008. Details of the materials used are provided [Appendix E](#) and a table showing student performance can be found in [Appendix F](#).

Interpreting the graphs

The graphs below show the spread of the student work, as produced by the FACETS software. The dots indicate the measure related to the relevant ranked script and the error bar "whiskers" represent the standard error of measurement (SEM) to the corresponding measure. The difference between sequential measures demonstrates the strength of the difference in the ranking position. Large differences would therefore illustrate that scripts were less close in terms of similarity of student performance than small differences. Therefore, there could be a larger difference in judged student performance between scripts ranked 1 and 2 than between those ranked 2 and 3 (the difference in student performance is not necessarily the same between ranked positions).

The SEM illustrates the level of confidence that the measure is accurate: the greater the SEM, the smaller the confidence levels. Therefore, large whiskers mean that there is less confidence that the measure was accurate. The whiskers illustrate the level of confidence, with upper and lower points at which the measure could lie.

The FACETS software will usually produce a rank order, even when there is little difference between the quality of the student work considered in the review. This is due to the natural slight variability between students who get the same mark. In these cases the rank order would show a relatively even spread of student work from different awarding organisations throughout the rank order.

The scripts have been separated by awarding organisation for ease of reference, represented in alphabetical order across the horizontal axis (but can be found as a continuous inter-awarding organisation list in table format in [Appendix G](#)).

Findings

Performance at the GCE AS grade-A boundary

We were unable to analyse Edexcel's 2008 scripts and OCR's 2003 scripts as we could not locate the full sample in Ofqual's archive. The data for these Awarding

Organisations in the graphs below therefore only refers to the years for which scripts were available in the archive.

All of AQA's 2003 scripts were ranked within the top half of ranked student scripts. The majority of CCEA's 2003 scripts were ranked within the inter-quartile range (the middle two quartiles) of the ranking positions, although skewed towards the lower end of the two quartiles. Edexcel's 2003 scripts were also concentrated within the inter-quartile range of the ranking positions.

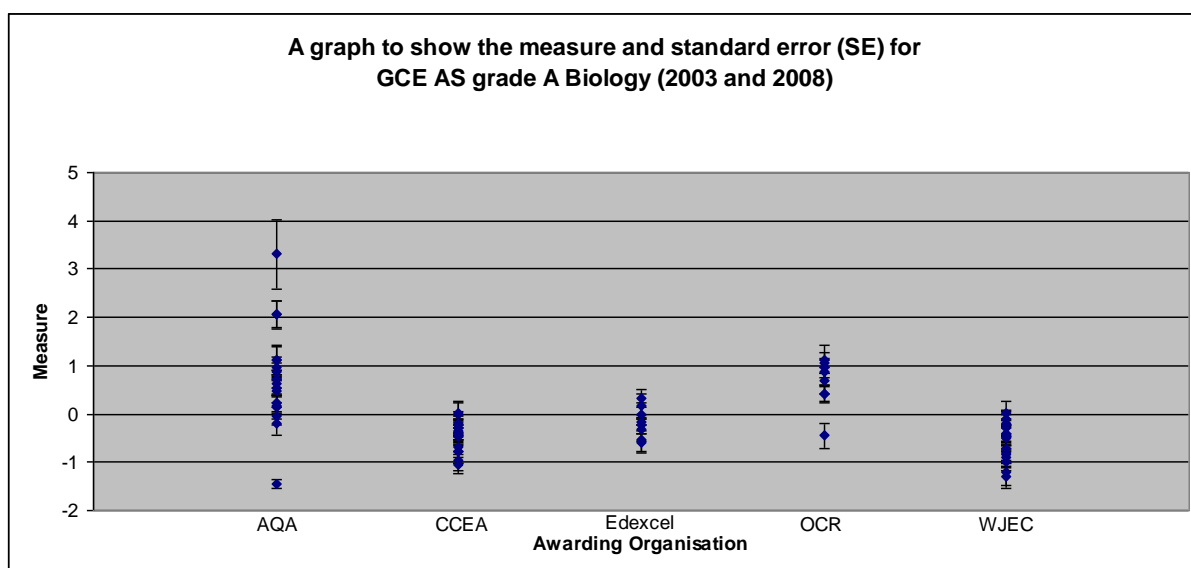
The majority of WJEC's 2003 scripts were ranked within the last quartile, with the remaining two scripts positioned within the second and third quartiles of ranking positions.

All but one of AQA's 2008 scripts were ranked within the top quartile, whereas the majority of CCEA's scripts were ranked within the bottom half of ranked positions. OCR's 2008 scripts were, in the majority, ranked within the top quartile of student performance.

WJEC's 2008 scripts were more evenly distributed throughout the rankings than for their 2003 scripts, with the majority ranked within the inter-quartile range of the ranking positions.

AQA and OCR's scripts performed most favourably, with the majority of their respective scripts ranked in the top quartile (it should be noted, however, that OCR did have significantly fewer scripts than AQA, CCEA and WJEC).

WJEC's scripts performed the least favourably of all awarding organisations with the majority of its scripts ranked within the bottom half of the rankings.



Performance at the GCE A2 grade-A boundary

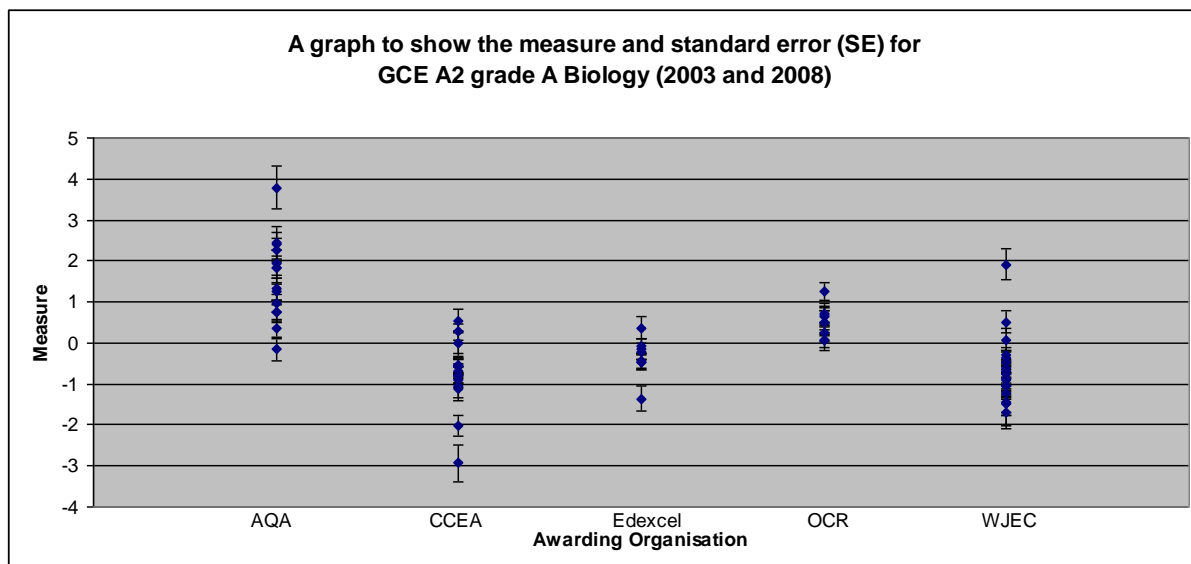
When looking at scripts from both 2003 and 2008, all of AQA's scripts were ranked within the top half of ranked student scripts, and CCEA's scripts were fairly evenly spread throughout the rankings, suggesting consistency of student performance at the grade boundary across the scripts reviewed.

The majority of Edexcel's 2003 scripts were ranked within the inter-quartile range of the ranking positions. WJEC's 2003 scripts performed the least favourably with all of its scripts ranked within the bottom half of the ranking positions.

All of OCR's 2008 scripts were ranked within the top half of ranked student scripts, but we did not review scripts from 2003 and so cannot comment on any changes over time.

WJEC's 2008 scripts were fairly evenly spread throughout the rankings. This suggests consistency of student performance at the grade boundary across the scripts reviewed, moving them into line with those of other awarding organisations, unlike in 2003.

The scripts provided by Edexcel from 2008 at this grade were incomplete. After analysis we found that this, rather than the quality of the student work, had the greatest impact on ranking. Therefore we decided to remove them from the analysis.

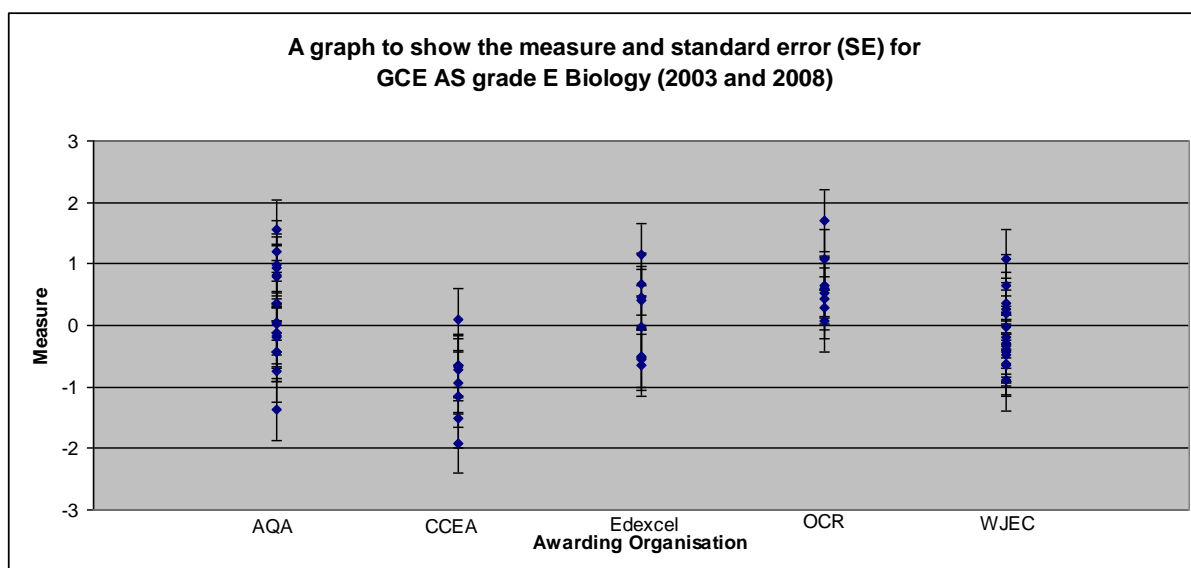


Performance at the GCE AS grade-E boundary

Scripts from 2003 for AQA, Edexcel and WJEC were all fairly evenly spread throughout the rankings, suggesting consistency of student performance at the grade boundary across the scripts reviewed. There were no scripts from CCEA or OCR available for review from 2003.

The majority of the 2008 AQA scripts were in the top quartile, whereas the majority of CCEA's scripts were ranked within the bottom quartile of the ranked positions. All of OCR's 2008 scripts were ranked within the top half of the ranking positions, and WJEC's scripts were ranked relatively evenly throughout the rankings.

The scripts provided by Edexcel from 2008 at this grade were incomplete. After analysis we found that this, rather than the quality of the student work, had the greatest impact on ranking. Therefore we decided to remove them from the analysis.



Performance at the GCE A2 grade-E boundary

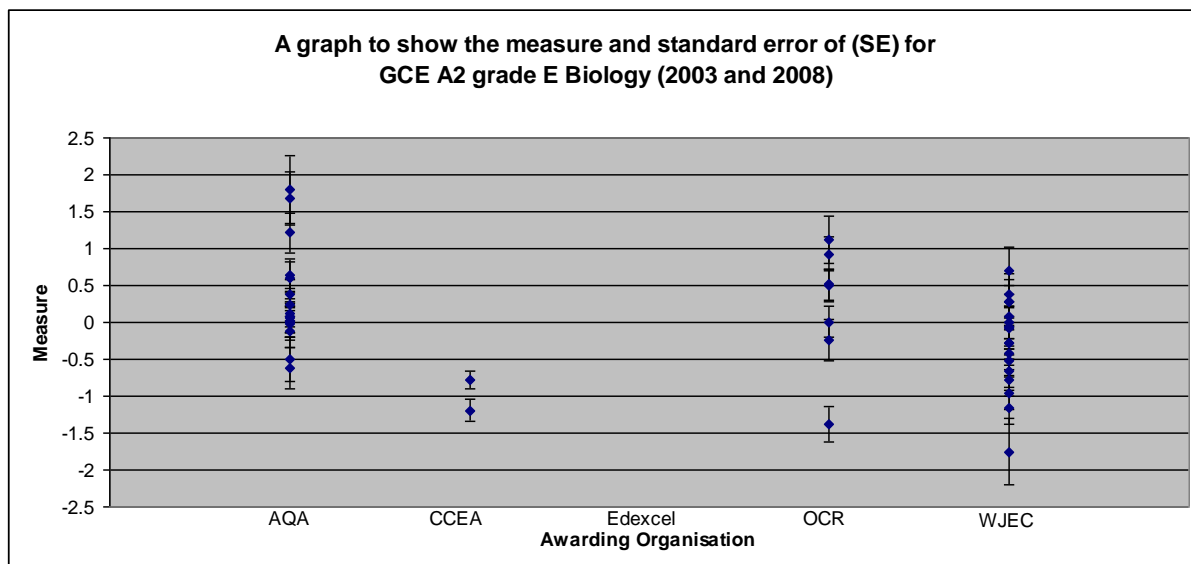
Only AQA and WJEC scripts from 2003 were available to review and, on balance, AQA's student scripts were ranked the higher of the two.

AQA, OCR, WJEC and CCEA had scripts available for review from 2008. However, only two scripts were available from CCEA.

AQA's, OCR's and WJEC's scripts were all ranked relatively equally throughout the rankings, with OCR ranked slightly higher and WJEC slightly lower.

Both of CCEA's scripts were ranked within the bottom quartile. However, since there were only two scripts reviewed, the ranking should be interpreted with caution.

The scripts provided by Edexcel from 2008 at this grade were incomplete. After analysis we found that this, rather than the quality of the student work, had the greatest impact on ranking. Therefore we decided to remove them from the analysis.



Conclusions

We are talking to higher education institutions, amongst others, about the content and demand of A levels in the future, so that they meet the needs and expectations of people use this qualification in the future.

Changes to the qualification and their impact on perceptions of the academic demand of the qualification and its suitability as preparation for higher education will inform the next generation of qualification and subject criteria as part of this process.

Specifically related to this review, we recommend that consideration is given to the following:

- Whether there should be tighter requirements on the proportion of a qualification that is permitted to be optional units.
- Whether there should be clear guidance on the suitability of certain types of question and task set which enable students at different levels of attainment to demonstrate their knowledge and skills.

Appendix A: Provision of assessment materials and student work at GCSE and GCE levels for Ofqual's archive (annual inclusion and standards reviews)

Section 1: Specification of requirements

1.1 Each awarding organisation should draw the materials for each subject from the specification with their largest entry in summer 2009, unless that selection severely limits the range of examination components available. Where there are several entry options, materials should be drawn from the largest option only, unless Ofqual were exceptionally to agree other arrangements.

1.2 (With regards to GCSE) – where there are both modular and linear (non-modular) examinations in a subject, the awarding organisation operating the modular scheme with the greatest number of students (amongst all awarding organisations) should include that modular scheme, even if it is not a specification within the awarding organisation's largest entry. Similarly, the awarding organisation operating the linear scheme with the greatest number of students should include that linear scheme. If an awarding organisation runs both the largest entry linear examination and the largest entry modular examination in a subject, it will therefore provide two sets of materials, including student work, where required.

1.3 The following materials should be supplied:

a) Current specification: all associated question papers and final mark schemes.

b) The 2009 report from the examiner and details of awarding procedures particular to the specification supplied.

c) An indication of how the specification's content and assessment criteria and objectives have been met in each question paper supplied. This may take the form of a grid. For objective tests this should include faculty values, discrimination indices and a specification grid detailing what grade each question was targeted at, as well as an indication of what percentage of students got a particular question correct when it was targeted at the grade they got overall.

d) Unit or component mark distributions (with grade boundary marks shown). It should be clear whether the marks are on the raw or uniform mark scale.

e) Grade boundaries, overall and by unit (both raw and scaled).

f) Student work as specified in Section 2.

g) Complete data record showing for each student selected the raw mark; final mark; weighted or uniform mark; grade for each component/unit (including any non-archived component/unit) and overall grade; and, where relevant, tier of entry.

Where appropriate, materials a)–e) may be supplied in electronic form.

Section 2: Student work

2.1 The work submitted should include the examination scripts, the internal assessment, and any oral/ aural examinations (with examiner mark sheet) where these are routinely recorded. In addition, for modular specifications, the examination papers of module tests should be supplied.

2.2 The sample should be of the original work of the students. Photocopies of work should only be used where it is impossible to send the originals and with agreement in advance by Ofqual. Student and centre names and numbers should be removed wherever they appear in a student's work, unless they form an integral part of the work, for example, within a letter.

2.3 Where an awarding organisation's specification has a relatively small entry or where, for some other reason, it is proving difficult to find sufficient students who fulfil the criteria, the awarding organisation should contact the Ofqual officer responsible to agree how best to finalise the sample.

2.4 All internal assessment submitted should be that of the particular students selected for the sample. If, for any reason, this proves to be impossible, the awarding organisation should contact the Ofqual officer responsible to agree appropriate alternative measures.

2.5 The sample of scripts retained for each specification (option) should be taken from students whose final mark lay at or near the subject grade boundaries for A/B, C/D and F/G for GCSE and A/B and E/U for GCE A-level qualifications. At each boundary, each awarding organisation will supply the externally and internally set and marked assessments of fifteen students. Students selected should be those whose performance across units is not obviously and significantly unbalanced.

2.6 In tiered subjects, where the same grade boundary may feature in two tiers, separate sets of student work for the boundary should be provided from each tier.

In addition for AS/A level specifications:

2.7 Where awarding organisations have to supply student work for an A level specification, two samples are required: one for the AS and one for the A2 units.

2.8 For AS level, the work of 15 students whose mark for the AS is at or close to the UMS boundary for an AS grade A (240) or grade E (120) should be supplied.

Students selected should be those whose performance across the three AS units is not obviously or significantly unbalanced. Students should have taken at least two of the three AS units in the June examination series.

2.9 For A level, the sample comprises the A2 work of 15 students who have gained c240 UMS marks at A or c120 UMS marks at E on their A2 units. Students selected should be those whose performance across the three A2 units is not obviously or significantly unbalanced. Students selected will ideally have also gained an overall A level mark which is at or close to the UMS boundary for an overall A level grade A (480) or grade E (240). Students should have taken at least two of the three A2 units in the June examination series.

2.10 The set of AS and A2 units provided should also be a valid combination for A level.

2.11 Where coursework forms a compulsory sub-component within a unit, that coursework should also be collected. Where a unit has optional sub-components, the highest entry option should be supplied. The students chosen for the sample should, as far as possible, have a performance across the components of the unit which is not obviously unbalanced.

Appendix B: Schemes of assessment

Awarding organisation	2003		2008	
	AS	A2	AS	A2
AQA	Unit 1: 75 mins Unit 2: 75 mins Unit 3: 75 mins and coursework	Unit 4: 90 mins Unit 5: 75 mins and coursework Units 6/7/8: 135 mins – choice of three papers (for Section A)	Unit 1: 60 mins Unit 2: 60 mins Unit 3: 60 mins and coursework	Unit 4: 90 mins Unit 5: 75 mins and coursework Unit 6/7/8: 135 mins – choice of three papers (for Section A)
CCEA	Unit 1: 60 mins Unit 2: 60 mins Unit 3: 45 mins and coursework	Unit 4: 90 mins Unit 5: 90 mins Unit 6: 60 mins and coursework	Unit 1: 60 mins Unit 2: 60 mins Unit 3: 60 mins and coursework	Unit 4: 90 mins Unit 5: 90 mins Unit 6: 60 mins and coursework
Edexcel	Unit 1: 60 mins Unit 2: 60 mins Unit 3: 60 mins written paper and coursework	Unit 4: 90 mins Unit 5: 90 mins Unit 6: 70 mins and coursework or written alternative 80 mins.	Unit 1: 60 mins Unit 2: 60 mins Unit 3: 60 mins written paper and coursework	Unit 4: 90 mins Unit 5: 90 mins Unit 6: 70 mins and coursework or written alternative 80 mins

OCR	Unit 1: 60 mins Unit 2: 60 mins Unit 3: 45 mins and coursework or practical exam 90 mins	Unit 4: 90 mins Unit 5: 90 mins (choice of one out of five units) Unit 6: 75 mins and coursework or practical exam 90 mins	Unit 1: 60 mins Unit 2: 60 mins Unit 3: 45 mins and coursework or practical exam 90 mins	Unit 4: 90 mins Unit 5: 90 mins (choice of one out of five units) Unit 6: 75 mins and coursework or practical exam 90 mins
WJEC	Unit 1: 100 mins Unit 2: 100 mins Unit 3: practical assessment 225 mins	Unit 4: 100 mins Unit 5: 120 mins Unit 6: practical assessment 240 mins	Unit 1: 90 mins Unit 2: 90 mins Unit 3: practical assessment 225 mins	Unit 4: 100 mins Unit 5: 120 mins Unit 6: practical assessment 240 mins

Appendix C: A level specifications reviewed

		Awarding organisation and specification codes				
		AQA	CCEA	Edexcel	OCR	WJEC
Year	2003	5416		8040	3881	31080
		6416	1010	9040	7881	31090
	2008	5416		8040	3881	31080
		6416	1010	9040	7881	005 890

Appendix D: A level scripts reviewed

		Awarding organisation									
		AQA		CCEA		Edexcel		OCR		WJEC	
Grade	Year	2003	2008	2003	2008	2003	2008	2003	2008	2003	2008
	AS	A	*15	*15	*9	*15	*14	*12	*0	*15	*15
A		**8	**8	**8	**8	**8	**8	**0	**8	**8	**8
E		*15	*15	*0	*15	*13	*16	*0	*15	*15	*15
E		**8	**8	**0	**8	**8	**8	**0	**8	**8	**8
A2	A	*15	*15	*12	*15	*15	*0	*0	*15	*15	*15
	A	**8	**8	**8	**8	**8	**0	**0	**8	**8	**8
	E	*15	*15	*0	*2	*0	*0	*0	*16	*15	*15
	E	**8	**8	**0	**2	**0	**0	**0	**8	**8	**8

* Number of student scripts (student work) received from the awarding organisation

** Number of student scripts used in the script review

Appendix E: Availability of specification materials for the purposes of this review

Materials	2003					2008				
	AQA	CCEA	Edexcel	OCR	WJEC	AQA	CCEA	Edexcel	OCR	WJEC
Specification	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Question paper	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mark scheme	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓
Report from the examiner	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓
Mark distribution	✓	✗	✓	✗	✓	✓	✗	✓	✓	✓
Grade boundaries	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓
Assessment grids	✓	✗	✗	✗	✗	✓	✓	✗	✓	✓

✓ Material was available and was used in the review

✗ Material was not available and was not used in the review

Appendix F: Student achievement by grade

Cumulative percentage of GCE A level Biology grades achieved, 2003 and 2008

Awarding Organisation and year	A	B	C	D	E	U	Total student entries
AQA 2003	23.34%	43.63%	63.92%	81.20%	93.94%	100.00%	12,481
AQA 2008	27.74%	49.30%	68.91%	84.63%	95.45%	100.00%	13,276
CCEA 2003	43.51%	66.23%	81.47%	92.50%	97.46%	100.00%	1,457
CCEA 2008	43.20%	67.03%	84.71%	94.31%	98.17%	100.00%	2,354
Edexcel 2003	22.00%	42.65%	61.62%	77.99%	92.07%	100.00%	7,477
Edexcel 2008	28.61%	49.89%	69.51%	84.13%	84.13%	100.00%	9,995
OCR 2003	22.02%	44.57%	65.65%	82.80%	82.80%	100.00%	13,266
OCR 2008	26.23%	48.63%	68.98%	85.77%	96.50%	100.00%	16,065
WJEC 2003	26.39%	51.11%	71.17%	87.88%	97.35%	100.00%	1,436
WJEC 2008	28.19%	52.09%	75.05%	88.49%	88.49%	100.00%	1,912

Appendix G: Measure, standard error (SE) and infit values of the ranked scripts

The “measure” value represents quality of student performance as judged by the reviewers. It is an estimate of where each script would be ranked if all the scripts were put in order from highest to lowest in terms of performance in a single list. Positive values represent the scripts in the top half of all those reviewed.

The SE is the standard error of the estimated measure value. This is likely to be an underestimate as the analysis changed the rankings (as completed by reviewers on the data-entry sheet for each session) into paired comparisons. The table below exemplifies this. There are four ranking positions. Each rank will be compared against every other position and not just in the order in which they appear.

Reviewer: number 1		Paired comparisons made					
Ranking position	Script number						
1	65	65,23	23,65				
2	23	65,48	48,65	23,48	48,23		
3	48	65,52	52,65	23,52	52,23	48,52	52,48
4	52						

Each of the ranked scripts will be paired with each of the other ranked scripts twice for comparison. So, for example, rank 1 will be compared with rank 2 and rank 2 will be compared with rank 1 (hence the paired comparison).

The Infit Z value provides an indication of fit. The higher values indicate that there is more disagreement about the ranking of scripts. For example, scripts that were sometimes ranked above good scripts but at other times ranked below poor scripts (therefore, not consistently positioned within the rankings).

The separation reliability value (infit mean squared) provided is an estimate of the proportion of variance in the script measures attributable to “true” variance as opposed to “error” variance. This is likely to be overestimated, as the analysis changed the rankings into paired comparisons. The separation value, therefore, is how spread the group of measures of the scripts is. The higher the separation value the better, as this indicates more confidence in the degree of separation between the

scripts (that is to say that there is more certainty in the discrimination between them, as observed by the reviewers during the ranking exercise). Therefore the order of the scripts (in terms of the quality of student performance) is more reliable for the sample of scripts reviewed. Note that the infit mean squared columns' information will always be a positive number (as it has been squared).

The scripts are listed by student performance, with the highest first.

Biology: GCE grade A at AS				
Measure	SE	Awarding organisation	Infit mean squared	Infit Zstd
3.31	0.72	AQA	0.97	0.1
2.07	0.28	AQA	1.08	0.4
2.06	0.29	AQA	0.98	0
1.13	0.28	OCR	0.93	-0.4
1.12	0.3	AQA	1.01	0.1
1.11	0.29	AQA	0.9	-0.6
1.05	0.22	OCR	0.93	-0.5
0.97	0.2	AQA	0.98	-0.1
0.95	0.21	OCR	1.08	0.7
0.88	0.19	AQA	0.96	-0.4
0.86	0.25	OCR	0.99	0
0.72	0.19	AQA	1.06	0.7
0.69	0.27	OCR	0.86	-1.2
0.62	0.28	AQA	1.03	0.2
0.55	0.18	AQA	1.02	0.2
0.49	0.26	AQA	1.07	0.6
0.42	0.17	OCR	0.98	-0.2

Biology: GCE grade A at A2				
Measure	SE	Awarding organisation	Infit mean squared	Infit Zstd
3.78	0.52	AQA	1.14	0.4
2.43	0.41	AQA	0.98	0
2.41	0.3	AQA	0.8	-0.9
2.27	0.3	AQA	0.95	-0.1
1.93	0.34	AQA	0.99	0
1.92	0.39	AQA	0.95	-0.1
1.85	0.41	AQA	1.01	0.1
1.82	0.24	AQA	0.99	0
1.34	0.3	AQA	1.03	0.2
1.27	0.22	OCR	1.03	0.3
1.27	0.22	AQA	0.99	0
0.97	0.21	AQA	1.1	0.9
0.76	0.27	AQA	0.95	-0.3
0.74	0.2	AQA	0.96	-0.3
0.7	0.19	OCR	1.03	0.3
0.68	0.28	OCR	1.37	2.3
0.66	0.2	OCR	0.93	-0.7

Review of Standards in GCE A level Biology: 2003 and 2008

0.4	0.18	OCR	1	0
0.32	0.18	Edexcel	0.91	-1.3
0.23	0.19	AQA	0.94	-0.9
0.18	0.19	AQA	0.98	-0.3
0.16	0.25	Edexcel	1.03	0.3
0.13	0.24	AQA	0.96	-0.4
0.02	0.24	WJEC	1.05	0.6
0.02	0.24	CCEA	1.08	1.1
0	0.24	Edexcel	0.95	-0.5
-0.02	0.26	CCEA	0.96	-0.4
-0.04	0.18	AQA	1.15	2.3
-0.1	0.17	WJEC	1.03	0.4
-0.17	0.17	Edexcel	1.02	0.4
-0.2	0.26	WJEC	1.01	0.1
-0.21	0.24	AQA	0.93	-0.8
-0.21	0.19	CCEA	1.21	2.9
-0.22	0.17	CCEA	0.97	-0.5
-0.22	0.2	WJEC	1	0
-0.23	0.17	Edexcel	1.01	0.1
-0.24	0.29	CCEA	1.09	0.9
-0.28	0.17	WJEC	1.03	0.5
-0.28	0.17	CCEA	1.05	0.9
-0.29	0.18	CCEA	1.07	1.2
-0.33	0.23	Edexcel	1	0
-0.35	0.17	CCEA	1.01	0.1

0.54	0.29	CCEA	1.14	1.2
0.51	0.29	OCR	1.07	0.4
0.51	0.27	WJEC	0.89	-0.9
0.49	0.3	AQA	0.95	-0.3
0.37	0.26	Edexcel	0.96	-0.2
0.36	0.21	AQA	0.93	-0.7
0.27	0.19	CCEA	0.98	-0.2
0.23	0.2	OCR	1.06	0.7
0.07	0.28	WJEC	0.89	-0.8
0.07	0.19	OCR	0.99	-0.1
0.06	0.26	OCR	1.02	0.2
0.01	0.26	CCEA	0.86	-1.4
-0.02	0.29	CCEA	0.99	0
-0.09	0.2	Edexcel	1.09	1.1
-0.14	0.26	Edexcel	1.03	0.3
-0.16	0.28	AQA	1.19	1.4
-0.21	0.19	Edexcel	1.02	0.2
-0.3	0.2	WJEC	0.96	-0.6
-0.37	0.18	WJEC	0.88	-1.6
-0.45	0.18	Edexcel	1.12	1.7
-0.46	0.2	Edexcel	0.95	-0.6
-0.46	0.19	Edexcel	1.05	0.7
-0.46	0.27	WJEC	0.91	-0.8
-0.54	0.18	CCEA	0.94	-0.8
-0.56	0.2	CCEA	0.97	-0.4

Review of Standards in GCE A level Biology: 2003 and 2008

-0.38	0.23	CCEA	1.06	0.7
-0.4	0.26	WJEC	0.89	-1.1
-0.41	0.18	WJEC	0.85	-2.7
-0.41	0.19	CCEA	0.99	-0.1
-0.45	0.26	OCR	0.88	-1.6
-0.47	0.18	CCEA	0.99	0
-0.47	0.18	WJEC	0.97	-0.4
-0.5	0.26	WJEC	1.01	0
-0.52	0.29	Edexcel	0.9	-0.9
-0.6	0.19	Edexcel	1.01	0.1
-0.68	0.23	CCEA	1.01	0.1
-0.73	0.27	WJEC	0.9	-1
-0.78	0.24	CCEA	1.12	1.4
-0.79	0.24	CCEA	1.05	0.6
-0.82	0.21	WJEC	1.02	0.2
-0.83	0.27	WJEC	0.89	-0.9
-0.9	0.17	WJEC	0.94	-0.8
-0.97	0.19	CCEA	1.06	0.7
-0.98	0.2	WJEC	1.09	1.1
-1.04	0.19	CCEA	1.01	0.2
-1.22	0.26	WJEC	1.01	0.1
-1.29	0.26	WJEC	0.96	-0.3
-1.44	0.09	AQA	0.98	-0.3

-0.58	0.19	CCEA	1	0
-0.58	0.19	CCEA	1.06	0.8
-0.63	0.21	WJEC	0.99	0
-0.68	0.2	WJEC	0.97	-0.3
-0.68	0.18	CCEA	1.01	0.2
-0.77	0.19	WJEC	1.01	0.1
-0.78	0.2	CCEA	1.1	1.2
-0.79	0.2	CCEA	1.02	0.2
-0.85	0.19	WJEC	1.01	0.1
-0.91	0.19	CCEA	1.06	0.8
-0.92	0.2	WJEC	1.02	0.3
-1.03	0.27	WJEC	0.96	-0.4
-1.03	0.29	WJEC	1	0
-1.06	0.27	CCEA	1	0
-1.11	0.28	CCEA	0.98	-0.1
-1.24	0.85	WJEC	0.78	-0.4
-1.36	0.3	Edexcel	0.96	-0.2
-1.46	0.29	WJEC	0.93	-0.4
-1.48	0.22	WJEC	0.96	-0.3
-1.48	0.3	WJEC	0.87	-0.8
-1.7	0.33	WJEC	1	0
-2.01	0.25	CCEA	1.04	0.2
-2.93	0.44	CCEA	1.02	0.1

Biology: GCE grade E at AS				
Measure	SE	Awarding organisation	Infit mean squared	Infit Zstd
1.71	0.39	OCR	0.96	-0.1
1.55	0.36	AQA	1.03	0.1
1.21	0.23	AQA	1.04	0.2
1.16	0.21	Edexcel	0.9	0.1
1.07	0.22	OCR	0.93	-0.6
1.07	0.29	WJEC	0.96	-0.6
0.99	0.32	AQA	0.89	0.3
0.93	0.21	AQA	1.07	-0.2
0.82	0.21	AQA	0.93	-0.7
0.8	0.27	AQA	1.01	-0.5
0.67	0.29	Edexcel	1.09	0.9
0.66	0.22	WJEC	1.03	0
0.64	0.27	OCR	0.91	0.6
0.61	0.29	OCR	1.07	0.4
0.52	0.2	OCR	1.09	0.4
0.46	0.21	Edexcel	1.1	-0.2
0.43	0.28	OCR	1	1.5
0.42	0.31	Edexcel	0.99	0.1
0.37	0.28	AQA	0.92	0
0.36	0.3	WJEC	1	-0.5
0.29	0.21	OCT	1.06	-0.1
0.27	0.24	WJEC	0.98	-0.7
0.2	0.19	WJEC	1.03	-0.8
0.1	0.28	CCEA	1.07	0
0.07	0.2	OCR	1.03	0.6
0.06	0.26	AQA	0.91	-0.3

Biology: GCE grade E at A2				
Measure	SE	Awarding organisation	Infit mean squared	Infit Zstd
1.8	0.46	AQA	0.91	-0.2
1.68	0.36	AQA	0.98	0
1.22	0.27	AQA	1	0
1.13	0.32	OCR	1.03	0.2
0.93	0.23	OCR	1.03	0.3
0.7	0.32	OCR	1.02	0.1
0.64	0.22	AQA	0.98	-0.2
0.61	0.21	AQA	0.97	-0.3
0.52	0.21	OCR	0.99	-0.1
0.51	0.22	OCR	1.13	1.5
0.38	0.29	WJEC	0.97	-0.2
0.38	0.21	AQA	1.12	1.4
0.29	0.3	WJEC	1.08	0.8
0.29	0.22	WJEC	0.93	-1
0.24	0.22	AQA	1	0
0.13	0.2	AQA	0.97	-0.5
0.09	0.19	WJEC	1.04	0.6
0.08	0.21	AQA	0.98	-0.3
0.06	0.2	AQA	0.97	-0.4
0.02	0.21	AQA	0.98	-0.3
0.01	0.21	OCR	0.93	-0.4
0.01	0.21	AQA	1.1	1.4
0.01	0.22	WJEC	0.95	-0.5
-0.02	0.22	AQA	1.11	1.5
-0.06	0.29	WJEC	1.04	0.3
-0.08	0.28	WJEC	0.9	-1.2

Review of Standards in GCE A level Biology: 2003 and 2008

0.02	0.2	AQA	1.03	0
-0.02	0.21	WJEC	1.01	0
-0.03	0.19	Edexcel	0.87	-0.8
-0.13	0.2	AQA	1	0
-0.16	0.34	AQA	1.07	0.6
-0.19	0.26	WJEC	0.97	1.5
-0.2	0.19	AQA	1.05	1.2
-0.29	0.18	WJEC	1.04	-0.9
-0.33	0.19	WJEC	1.05	1.2
-0.4	0.2	WJEC	0.97	-0.9
-0.4	0.27	WJEC	1.11	1.1
-0.42	0.28	AQA	1.01	0.2
-0.42	0.2	AQA	1.02	0.6
-0.43	0.28	WJEC	0.95	-0.7
-0.48	0.2	WJEC	0.97	-0.7
-0.51	0.19	Edexcel	0.99	0.2
-0.56	0.21	Edexcel	0.97	0.4
-0.63	0.18	WJEC	1.09	-0.4
-0.64	0.2	CCEA	1.01	0
-0.65	0.21	WJEC	0.95	0.7
-0.65	0.26	Edexcel	1.08	-0.4
-0.67	0.29	CCEA	0.92	0
-0.72	0.3	CCEA	1.1	-0.4
-0.75	0.19	AQA	1.02	0.3
-0.89	0.19	WJEC	0.96	-0.4
-0.93	0.24	CCEA	1.07	0
-1.15	0.22	CCEA	0.93	0.2
-1.36	0.09	AQA	1.01	0.7
-1.5	0.21	CCEA	1	1.2
-1.91	0.22	CCEA	0.91	0

-0.12	0.21	AQA	0.9	-1.5
-0.23	0.28	OCR	0.99	-0.1
-0.27	0.22	WJEC	0.84	-2.3
-0.28	0.22	WJEC	1	0
-0.42	0.21	WJEC	1.09	1.2
-0.49	0.3	AQA	0.89	-0.8
-0.52	0.2	WJEC	0.97	-0.4
-0.61	0.28	AQA	0.93	-1
-0.66	0.22	WJEC	1.01	0.1
-0.78	0.21	WJEC	1.02	0.3
-0.78	0.12	CCEA	1.05	1
-0.95	0.22	WJEC	1.01	0.1
-1.15	0.23	WJEC	0.91	-0.9
-1.19	0.14	CCEA	1.03	0.4
-1.38	0.24	OCR	1.03	0.3
-1.75	0.46	WJEC	0.85	-0.4

Appendix H: Review team

Review team	Organisation	
Lead reviewer	Kathleen Evans	Ofqual reviewer
Specification reviewers	Annette Love	Ofqual reviewer
	Erica Clark	Ofqual reviewer
	John Gogarty	Ofqual reviewer
Script reviewers	Patrick McCann	Ofqual reviewer
	Neil Ingram	Ofqual reviewer
	Gail Black	Ofqual reviewer
	Deborah James	Ofqual reviewer
	Amina Shah	Ofqual reviewer
	Mark Smith	Ofqual reviewer
	Bill Indge	AQA
	James Napier	CCEA (awarding organisation)
	Nigel Wright	Edexcel
	Fran Fuller	OCR
	Gareth Rowlands	WJEC
	Lorna Monroe	Association for Science Education
	Caroline Still	Society of Biology
John Campton	CCEA Regulator	

Appendix I: Assessment objectives

The assessment objectives will assess a student's ability in the following areas.

AO1 Knowledge with understanding

Students should be able to:

- (a) recognise, recall and show understanding of specific biological facts, terminology, principles, concepts and practical techniques;
- (b) draw on existing knowledge to show understanding of the ethical, social, economic, environmental and technological implications and applications of biology;
- (c) select, organise and present relevant information clearly and logically, using specialist vocabulary where appropriate.

AO2 Application of knowledge and understanding, analysis and synthesis and evaluation

Students should be able to:

- (a) describe, explain and interpret phenomena and effects in terms of biological principles and concepts, presenting arguments and ideas clearly and logically, using specialist vocabulary where appropriate;
- (b) interpret and translate, from one form into another, data presented as continuous prose or in tables, diagrams, drawings and graphs;
- (c) apply biological principles and concepts in solving problems in unfamiliar situations, including those which relate to the ethical, social, economic and technological implications and applications of biology;
- (d) assess the validity of biological information, experiments, inferences and statements.

AO3 Experiment and investigation

Students should be able to:

- (a) devise and plan experimental and investigative activities, selecting appropriate techniques;
- (b) demonstrate safe and skilful practical techniques;
- (c) make observations and measurements with appropriate precision and record these methodically;

(d) interpret, explain, evaluate and communicate the results of their experimental and investigative activities clearly and logically using biological knowledge and understanding, and using appropriate specialist vocabulary.

Assessment objective 4 applies only to the A2 part of the A level course.

AO4 Synthesis of knowledge, understanding and skills

Students should be able to:

(a) bring together principles and concepts from different areas of biology, and apply them in a particular context, expressing ideas clearly and logically and using appropriate specialist vocabulary;

(b) use biological skills in contexts which bring together different areas of the subject.

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