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General Certificate of Secondary Education

Science CAU 4460

Science A 4461 (SCYC)

Science B 4462 (SCYC)

Additional Science 4463 (ASCC)

Biology 4411 (BLYC)

Chemistry 4421 (CHYC)

Physics 4451 (PHYC)

Report on the Examination

2011 examination – June series

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GCSE Science 2011
Centre Assessed Unit - 4460

Principal Moderator's Report

This report covers the fourth submission for moderation of the coursework for the 2006 new specifications in GCSE Science. Because of the confidential nature of the ISAs, which are still currently operational, this report cannot deal with specific references to particular ISAs, but rather deals with the overall general performance of the component this year. Centres that have particular questions about specific ISAs should make enquiries of their Centre Assessed Unit Adviser.

1. General Structure of the Centre Assessed Unit

The total number of raw score marks for the CAU is 40. This comprises 6 marks from the PSA and 34 marks from the ISA.

The ISAs may be used for more than one subject. ISAs have a shelf life of two years, but may be submitted for moderation for one further year providing that they have been completed within their shelf life.
A total of 27 ISAs were eligible for moderation this year (see table opposite).

Moderation is only carried out once per year. Requests for moderation should be submitted by 21 February each year, using the appropriate code:

- Science - SCYC - one ISA from B1, C1 or P1
- Additional Science - ASYC - one ISA from B2, C2 or P2
- Biology - BLYC - one ISA from B1, B2 or B3
- Chemistry - CHYC - one ISA from C1, C2 or C3
- Physics - PHYC - one ISA from P1, P2 or P3

Centres may also request that the marks for this component are carried forward from one subject to another appropriate subject. For example, if a candidate has previously submitted an ISA in B1 for moderation for Science, this mark may be carried forward for subsequent certification in Biology.

If a centre wishes to transfer the ISA to a different subject after making the initial entry in February, this may be done without charge up to 21 April.
Marks must be submitted by 7 May each year. It is the total mark out of 40 (ie PSA plus ISA) that must be entered on the Centre Mark Form.

2. Practical Skills Assessment (PSA)

The criteria for the award of these 6 marks are based on 6 "Can-do" statements. These may be assessed at any time during the course when candidates are carrying out practical work. The mark should represent the typical achievement of the candidate by the end of the course. Centres are not required to submit any records or justification for their arrival at the final mark, as this component is not moderated. The intention is that the component should be formative and motivating, especially for the lower ability candidates.

Centres appear to have made a fair and realistic assessment of their candidates this year. As would be expected if the candidates had shown improvement over the course, the majority of the marks awarded for this component were weighted towards the top of the mark range. However, moderators noticed a tendency in some centres for awarding a preponderance of 6

marks for the PSA, which did not appear to be matched by the candidates' performance in the practical aspects of the ISA.

Although no written evidence or justification for the marks is required, conversations with centres have revealed that the vast majority of teachers have either designed their own record form for this or have adopted the suggested format shown on page 35 of the Centre Assessed Unit – Information for Centres & Marking Guidance 2008/2009 Issue No. 3. This booklet was given to delegates at the Teacher Standardising Meetings and can be found in the Support Materials area on the website. The mark for the PSA should be entered in the appropriate space on the reverse of the Candidate Record Form (for Set 3 & 4 ISAs) or on the front cover of the ISA (for Set 5 ISAs onwards). A few centres neglected to do so this year and consequently were potentially depriving their candidates of up to 6 marks. When moderators spot this they will contact the centre in order to put things right; however, this does severely delay the moderation process and could lead to delayed results.

3. Investigative Skills Assignment (ISA)

This component comprises the bulk of the marks for the CAU (34 marks). Candidates carry out an investigation based on one of the ISAs set by AQA.
Centres may allow candidates to carry out as many ISAs as they wish: for each candidate however, only the one ISA that resulted in the highest mark for each subject should be submitted for moderation.
The ISAs available for moderation in 2011 were:

Set 3		
B1.4 – Caffeine	**C1.5** – Investigating Plastics	**P1.4** – Keeping Warm
B2.3 – Diffusion	**C2.3** – Investigating Catalysts	**P2.3** – Momentum
B3.3 – Yeast	**C3.3** – Investigating Acidity	**P3.3** – Electromagnets
Set 4		
B1.5 – Killing microorganisms	**C1.6** – Properties of oils	**P1.5** – Solar cells
B2.4 – Staying cool	**C2.4** – Energy changes	**P2.4** – Thermistors
B3.4 – Yoghurt	**C3.4** – Solubility	**P3.4** – Cantilevers
Set 5		
B1.6 – Distribution of Plants	**C1.7** – Metal Ores	**P1.6** – Generating Electricity
B2.5 – Enzyme Action	**C2.5** – Precipitates	**P2.5** – Crumple zones
B3.5 – Breathing	**C3.6** – Neutralising alkalis	**P3.5** – Refraction

ISAs from Sets 1, 2, 3 and 4 have now reached their expiry date and may therefore be used for practice with candidates.
Any Set 4 ISAs that have been completed by candidates prior to 31 July 2011 may still be submitted for moderation in 2012.
Set 6 ISAs will be issued to centres at the beginning of September 2011.

3.1 Support for the Centre Assessed Unit

- **Teacher Standardisation Meetings**

The AQA Moderation Team has run a number of half-day standardisation meetings for teachers. A limited number of these meetings will be available in the autumn of 2011. At these meetings, teachers are provided with standardising material and are able to ask questions about the ISAs. Places at Teacher Support and Standardisation Meetings may be booked through the AQA web site.

- **Centre Assessed Unit (CAU) Advisers**

Each centre has been allocated a CAU adviser. Centres are informed of the name and contact details of their adviser in September each year. Centres who do not have these details should contact the Science Department at AQA Guildford. The CAU Adviser contacts the centre at least twice a year to offer their services.
Many centres made good use of their advisers this year. Centres that had problems at the moderation stage were nearly always centres that had not made contact with their adviser.

3.2 Internal Standardisation and the Centre Declaration Sheet

It was apparent to moderators that those centres where a teacher had attended a standardisation meeting were far less likely to have their marks adjusted. However, it is a requirement that, if more than one teacher at a centre is responsible for the marking, a procedure of internal standardisation should be carried out.
The easiest way to do this is for the teacher who attended the meeting to use the exemplars and PowerPoint presentations that are provided at the standardisation meeting.

In some cases, it was apparent to moderators that such internal standardisation had not taken place. This could result in the marks of some candidates at the centre being changed. It should be remembered that all the ISAs are moderated as a single subject. Teachers therefore need to standardise across all the ISAs in all the different subjects. If, for example, the biology and chemistry marks are judged to be in tolerance, but the physics marks are out of tolerance, this could result in all of the candidates' marks at that centre being adjusted. Centres will receive one feedback form that covers all of the subjects entered.
In some centres this year, internal standardisation had clearly taken place as ISAs had been 'overmarked' by a second teacher. This is good practice, but it is suggested that the second marker should use a different coloured pen, eg green. It is most important however that the centre makes clear which of the two marks is the final one that should have been submitted to AQA and the moderator.

Centres are required to complete a Centre Declaration Sheet confirming that internal standardisation has taken place, and to submit this to the moderator. Moderators reported that in several cases centres had failed to do this and had to be reminded to submit the form. This slows down the moderation process and in extreme cases may lead to the delay in the issue of results to a centre.
Please note that only one Centre Declaration Sheet is required from a centre, regardless of how many of the science subjects are entered.

3.3 Provision of ISAs

The fundamental basis of the scheme is that the Centre Assessed Unit – ISA and PSA - should be part of the teaching and learning process and not a "bolt-on" extra. Teachers are provided with an outline of each ISA as early as March of the previous academic year in the publication of Teachers' Notes. This enables them to plan in advance when an ISA will fit into their teaching scheme.
The actual ISA tests and corresponding Mark Guidance schemes are issued to the Examinations Officer in September via e-AQA. Science departments are entitled to be given one printed copy of each ISA and Mark Guidance, which they should keep secure within the department. Other copies should be printed off as and when required for issue to candidates.

3.4 Choice of ISAs

ISAs for Science (SCYC) must always have the number 1 before the decimal point, eg B1.4, C1.3

ISAs for Additional Science must always have the number 2 before the decimal point, eg C2.2, P2.4

ISAs for the separate science subjects of Biology, Chemistry and Physics may have 1, 2 or 3 before the decimal point, but must be relevant to that subject, eg for Biology B1.3, B2.2 or B3.4

A few centres this year submitted ISAs whose shelf life had expired. If centres are in doubt they should consult with their CAU adviser before undertaking the ISA.

3.5 Operation of ISAs

Candidates carry out an investigation, having been provided with an outline plan by the teacher. They subsequently take the ISA test. Section 1 of the ISA asks them questions about their own investigation, the questions being based upon Section 17 of the specification, "How Science Works". Section 2 of the ISA describes a situation in the same related area, and asks them questions about this.
It is recommended that teachers should look at the ISA question paper before deciding on the method to be used for the practical work. The reason for this is that if teachers use a different technique they could be disadvantaging their candidates when it comes to answering questions on Section 2 of the ISA. Teachers are not prohibited from using a different technique, but should be aware of the implications of so doing. Whatever decision they reach on this matter, teachers should complete an ISA Explanation Sheet to inform the moderator.
There are three stages in the process of administering an ISA.

3.5.1 Stage 1

(a) The task

AQA provides teachers with a suggested approach to carrying out the investigation. However, AQA cannot provide detailed instructions, as conditions and availability of equipment will vary greatly from one centre to another. Teachers must therefore carry out their own risk assessments of any procedure used.
Teachers may adapt or amend the suggested approach. This enables teachers to tailor the investigation to fit in with their own teaching scheme. Whether or not the suggested approach has been amended, centres must complete an ISA Explanation Sheet that gives details to the moderator of how the investigation was carried out. In many cases this year this was not done. Consequently moderators had great difficulty in confirming the award of marks in Section 1 of the ISA.

One ISA Explanation Sheet is required for each different way in which an ISA has been carried out.

Teachers need to provide candidates with an *outline* method of carrying out the investigation, ie they should demonstrate the technique but leave candidates to decide for themselves issues such as the range and interval of the independent variables and the number of repeats. If candidates are provided with a printed worksheet, a copy of this should be submitted to the moderator. A teacher should produce an ISA explanation sheet for each class experiment at the time that the practical is completed. It should be kept with the class ISAs and an annotated

mark guidance sheet that the teacher used to mark the ISA.
It is then ready to send to the moderator should a sample be required from that class.

(b) The table of results

At the end of Stage 1, candidates must, *on their own,* produce a blank table ready for the results.
This needs to be marked by the teacher **before** the candidates proceed to carry out the practical investigation.
The table should be able to accommodate all the data that the candidate is actually going to measure and/or record during the investigation. There is no need for columns to be provided for repeats, means or any derived values. These may be included in the table if the teacher so wishes, but there are no marks awarded for their provision.

Candidates should be encouraged to use full titles for the headings on the table, eg "Length of leaf", not just "Length"; "Time taken for the reaction to complete", not just "Time", "Volume of oxygen produced", not just "Volume". Units should also be included.
In some cases teachers had returned these tables to candidates after marking them. If the candidate subsequently alters the table (eg by adding units previously omitted) the teacher should annotate the table to inform the moderator of this. Failure to do so made it difficult for moderators to assess whether or not the correct mark had been awarded.

Many teachers now adopt the policy of either photocopying the original blank table before returning it to the candidate, or, after collecting the blank table, issuing the candidate with a blank table provided by the centre. Either of these strategies is perfectly acceptable.
The mark for the table (0, 1 or 2) should be entered in the right-hand margin adjacent to the last question in Section 1 of the ISA. Failure to do so this year led to some teachers arriving at an incorrect total mark.

3.5.2 Stage 2

(a) The practical work

Candidates now carry out the practical work, working in small groups if necessary. It is important that each candidate should take part in this practical session. Any candidate who does not take an active part in this stage cannot score any marks for Section 1 of the ISA.
It is also important that each candidate should, wherever possible, obtain his or her own results. Only if this proves impossible should a teacher issue a candidate with a copy of another candidate's results.
This year moderators found a small number of instances where all the candidates at a centre had been using the same set of results. This is not generally acceptable. There may be occasions when it is necessary to pool the results of several candidates in order to be able to identify a pattern. An example of this might be a fieldwork investigation. In such cases however, it must be made clear to the moderator which of the results that particular candidate had been responsible for obtaining. This is most easily done by including the candidate's own table of results as well as that of the combined group.

(b) Drawing the graph or bar chart

At the end of Stage 2, candidates must, *on their own*, draw a suitable graph or bar chart. Some of the issues that were identified during moderation are listed below.

- Categoric variables should be displayed on a bar chart
- Continuous variables should be displayed on a line graph

- Discrete variables may be displayed on either a bar chart or a line graph
- The maximum marks to be awarded if the candidate has used the wrong type of display is 3
- Although the convention is to plot the independent variable on the x-axis, there is no penalty for reversing the axes
- Candidates should use a scale in which the data occupies at least one third of the range shown on the axis
- One plotting error is allowed out of every 5 points plotted (providing that at least 5 points have been plotted)
- If a candidate finds that there is no correlation between the independent and the dependent variable, then in order to qualify for the 4th mark in drawing a line graph, the candidate should annotate the graph to this effect, eg by writing 'No line possible'.

There are a few special cases, mainly in biology, where it is acceptable to draw a dot-to-dot graph line. For example, suppose you were measuring the pulse rate of a person every hour, on the hour, throughout the day. You have no way of knowing what the pulse rate was between these readings, and therefore the Society of Biology recommends that a dot-to-dot line should be drawn. If the teacher feels that the investigation carried out by the candidate comes into this category, then an annotation to this effect should be made.

As with results tables, candidates should be encouraged to write full titles on the graph or chart axes.
The mark for the graph (0, 1, 2, 3 or 4) should be entered in the right-hand margin adjacent to the last question in Section 1 of the ISA. Failure to do so this year led to some teachers arriving at an incorrect total mark.

3.5.3 Stage 3

Taking the ISA test

The final stage involves candidates taking the ISA test. Some centres treated this as a normal examination and used the examination hall. Other centres felt that it was manageable to carry out the tests in the normal teaching room. Either approach is acceptable.
All of the standard procedures for special consideration that apply to written examinations are available for the ISA. These include the provision of extra time, the use of a scribe and the use of a reader.
Moderators reported that in some cases there was evidence that candidates who had difficulty in writing had not been provided with the services of a scribe. Centres are encouraged to use this provision where it is appropriate.
Please note that ISA papers must **never be given back to candidates** for them to amend their work or for them to see where they have gained or lost marks. If teachers want to carry out a practice ISA that can be returned to candidates then they should use either a specimen ISA or an ISA from a set whose shelf life has expired.

4. Marking the ISA test

AQA provides teachers with a Mark Guidance scheme for each ISA. Teachers are required to use their professional judgement in marking the test, which is subsequently moderated by AQA. One of the main difficulties encountered by moderators was the manner in which teachers marked the scripts.

Teachers are requested to mark in red ink, to put a tick in the body of the script for every mark awarded, and to enter a subtotal in the margin. This is the policy used by examiners when marking exam scripts.
In many cases, teachers were marking in pencil, not putting ticks in the main body of the script and not putting subtotals in the margin. This made it difficult to for moderators to see where and why marks had been awarded, and led to errors in addition.

4.1 Annotation

The Mark Guidance suggests typical answers that a candidate may provide. However, if a candidate provides an answer that, in the judgement of the teacher, correctly answers the question, then a mark should be awarded. In such cases the teacher should provide **annotation,** either to the ISA or to the mark guidance sheet or both, to indicate the reasons for the judgement.
The level of annotation on the scripts varied greatly. It is a QCDA / OFQUAL requirement that teachers should annotate the work to show where and why marks have or have not been awarded. Some centres were excellent in this respect; others put no annotation on at all, leaving moderators wondering why marks had been awarded.

A simple and quick way of providing annotation when the teacher thinks that it is a marginal decision as to whether or not the mark should be awarded is the use of the 'D' for doubt. The way in which this should be used is explained in the Guidance and Standardising Material for ISAs.
More centres this year adopted this policy and in doing so made it much easier for moderators to approve their marking standards. All centres are encouraged to use this strategy in the future.

There is always one question that contains the Quality of Written Communication (*QWC*) mark. There is always a statement within the rubric that alerts the candidate to this. In several centres, teachers had failed to indicate whether they had awarded this mark or not. In addition to the marks for the science within the question, teachers should indicate that they have considered the QWC mark by putting a Q✓ or a Q✗ somewhere within the script. In this way moderators know that the mark has been considered.

The Quality of Written Communication (QWC) question often requires the use of technical terms. In such questions, the Marking Guidelines clearly states the number of technical terms required, and suggests a list of acceptable terms. However, this list is not exhaustive or exclusive, only exemplary. Teachers should therefore use their professional judgement in deciding whether other terms are acceptable.
The main requirements are that:

1. The term should be relevant to the question
2. The term should be used in such a way that the candidate indicates an understanding of the meaning of the term.

Teachers should circle those terms that they consider are contributing to the award of the QWC mark.

4.2 Section 1 of the ISA

This section contains questions concerning the candidate's own investigation.
Set 4 and 5 ISAs contain a question at the end of Section 1 that requires candidates to draw a conclusion from their investigation by looking for possible links between the independent and the dependent variables. The question is divided into parts (a) and (b) in order to provide some

structure for the candidates. When marking this question however, teachers should read through both parts and treat it as one 4-mark question.
Many candidates failed to obtain maximum marks because they had not quoted any data from their results in order to support their conclusion.

4.3 Tables

Blank tables, suitable for the collection of data, must be drawn and marked before the practical work begins. In some cases centres had then returned these blank tables to the candidates for them to use during the practical work. This is acceptable providing that the teacher annotates the table to say that this is what has occurred. If no such annotation exists, the moderator cannot tell whether, for example, the candidate has put in units before or after the table has been marked.

4.4 Graphs and charts

Generally these were done well, although in a few cases centres had allowed their candidates to use ordinary lined paper instead of graph paper.
Candidates should use a sensible scale that maximises the available space whilst still providing an easy to interpret interval. Although there are occasions when it is desirable or even essential to show the origin, in many cases it is not. Candidates should therefore not be penalised for not showing the origin if it is not essential.
If the variables are continuous, then the most appropriate method of display is a line graph. In the vast majority of cases, a line of best fit (trend line) is the most appropriate line to draw. In GCSE Science AQA has always asked centres to instruct candidates to use a Line of Best fit rather than dot-to-dot lines for all occasions in all three GCSE sciences. However, the Society of Biology expresses the view that in certain circumstances a dot-to-dot line is the most appropriate. Candidates should not be penalised if, in the professional opinion of the teacher and in that particular case, the joining of dot-to-dot is appropriate in biological experiments. If this is the case then the work should be annotated to that effect.

5. Administrative matters

Some centres were very late in applying for moderation. Usually this was because they had not realised that applying for a subject award does not automatically mean that the Centre Assessed Unit will be moderated: a separate code needs to be submitted to request moderation.
Moderators have reported that although a few teachers were either slightly severe or rather lenient in their interpretation of the mark guidance, the majority were within tolerance. The moderation tolerance on this component is ±2 out of 34 (the PSA mark out of 6 is not included in moderation). Comparatively few centres exceeded tolerance and these were mainly centres that had failed to send a teacher to a standardisation meeting.

6. Submission of work to the moderator

Centres are asked to circle the candidate with the highest score and the candidate with the lowest non-zero score, on the Centre Mark Forms. This makes the process of candidate script selection for the sample much easier for the moderator. Many centres unfortunately failed to do this. If centres can easily provide a rank order list, this is much appreciated by the moderators.
ISAs from Set 5 onwards have a different front cover sheet that incorporates the Candidate Record Form. There is no need therefore for a separate Candidate Record Form to be completed for these ISAs. However, a separate Candidate Record Form should have been completed for set 3 and Set 4 ISAs. Unfortunately, many centres this year failed to do so and

had to be asked to supply one, thus slowing down the moderation process. Whichever version is used, both the candidate and the teacher must sign in the appropriate place.

The graph or bar chart and the table(s) of results for each candidate should be **stapled to the back** of the ISA test. **Please do not enclose candidates' work in plastic wallets or folders.** Centres should enclose an ISA Explanation Sheet for each different method used for each ISA. This year many centres failed to do so. In some cases this made it very difficult for moderators to assess whether or not marks had been appropriately awarded. This in turn often led to a delay in moderation as the centre had to be contacted and asked to supply details of the procedure used.

The **Centre Declaration Sheet** must also be enclosed with the sample. Most centres did remember to do so this year, but several forgot either to obtain the Head of the Centre's signature or failed to obtain the signatures of *all* of the teachers who had been involved in the marking of the ISAs.
Some centres that had entered candidates for the separate sciences as well as Science and Additional Science did not realise that if the **total number of entries from all subjects added together exceeds 20**, they should send the pink and yellow copies of the Centre Mark Forms to the moderator. This led to some centres that had entered fewer than 20 candidates for all five subjects sending all of the work to the moderator, often at different times. This in turn led to a delayed start to the moderation process for those centres.

Centres are urged to ensure that the correct marks are entered on the Centre Mark Forms. This year there was an increase in the number of centres that, when supplying the sample scripts to the moderator, enclosed a letter containing a list of marks that had been changed from the original ones put on the Centre Mark form. In some cases, it was unclear whether or not AQA had been informed of such changes.

7. Conclusions

In general, moderators were very pleased with the efforts that centres had made in both the execution of the ISAs and in their preparation of the sample material.

The marks were spread over the full range available.

Mark Ranges and Award of Grades
Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

UMS conversion calculator www.aqa.org.uk/umsconversion