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Moderators' Report/
Principal Moderator Feedback

June 2011

GCSE Internal Assessments Activities (IAAs)

2101 Science
2103 Additional Science
2105 Biology
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360 Science Internal Assessments Activities (IAAs)

GCSE Science, Additional Science, Biology, Chemistry and Physics

Overview

The Principal Moderators are very pleased to report that the vast majority of Centres made internal assessments, which were identical to, or close to, those of the moderating team. Most Centres have taken on board the advice given in training, the guidance materials for series 4 and 5 from the website, previous E9s, and the Principal Moderators' report from July 2010 and November 2010.

There was a predominance of series 4 Internal Assessments Activities (IAAs) for both Core and Additional Science. This was the last time series 4 IAAs were available for moderation: for future moderation sessions, centres will only be able to send series 5 IAAs. Series 5 IAAs will continue to be valid until March 2013: there will be no series 6. Most centres are referring to the published guidance materials, and this has helped them standardise across the disciplines. The annotation seen on most scripts was also more detailed, and referred to the guidance material. This made it easier for moderators to see where centres were awarding marks.

The IAAs continue to discriminate well between students of different ability levels. The marks achieved ranged from single figures to the maximum mark of thirty-six. However, where single figures were seen, the main reason was lack of any response to some questions rather than completely wrong answers. There was an increase in the number of students achieving higher marks, and this may reflect the amount of time centres are putting into AfL and making sure that the students are adequately prepared for the IAA.

It was also very clear that in almost all centres, the advice relating to the conduct of the suggested practical work had been followed and that their students had benefited as a result. A few centres chose to adapt the practical's, although it was not always clear why, and their students found this confusing when they came to discuss their results and compare them to those on the IAA. Centres are reminded that if they are thinking about changing the practical, then they should first discuss this with Edexcel (via Ask The Expert). Following the completion of practical work relating to each IAA, teachers are advised to spend some time with their students giving hints and tips about generic issues such as the detail which must be included in the writing of a plan, the meanings of terminology such as 'reliability' and 'validity', how best to present data in graphs, how to describe the pattern in a graph using scientific ideas, and how best to deal with the data in coming to a conclusion.

Just prior to the taking of the IAA by students, the relevant "students information sheet" should be given to them (please see the rubric for each IAA). The IAA itself can then be taken either in formal exam conditions, or in controlled conditions in the classroom/laboratory, as deemed most appropriate by the staff in each centre.

Where students' answers would benefit from a diagram but there is no space allocated, many seemed to assume that they were meant to use 'a thousand words' instead. Centres should encourage students to use relevant and useful diagrams if this helps their answer.

Following the teacher assessment, extracts from student work can be used for formative assessment in preparation for students taking subsequent IAAs. Teachers are advised to read the rubric for each IAA carefully, especially with regard to the attachment of student graphs from in-class experimental work. Some IAAs require these graphs, others do not. The majority of centres now routinely send graphs attached to student's work.

It was evident that in the majority of centres, science teachers had carefully applied the assessment criteria and had carried out internal standardisation in a professional manner. There was, however, evidence from a number of centres that the work had been “remarked” by another teacher. In instances where these two marks agreed, there were few problems, but there were a number of centres where the two marks disagreed significantly, and this showed that the centre had not standardised. It was not clear in these instances why the centre had favoured one marker over another. In a number of instances the first marker had been more in line with the moderator. Centres are advised, in situations like these, to discuss the range of marks and reach a joint decision that can be supported by the department. Where there were disagreements between the script and the OPTEMS, it was because an average of the two marks had been put on the OPTEMS but not the script.

Generic Assessment Grid

Levels of Performance **Stages**	**Mark Band 1** **Performance not worthy of credit**	**Mark Band 2** **Low level performance**	**Mark Band 3** **Standard level performance**	**Mark Band 4** **High level performance**
Planning	Students can only give isolated facts not specifically related to the task under consideration 0 Marks	*Students can* a. show some awareness of how scientific information can be collected b. plan a simple scientific task 1 – 4 Marks	Students can a. show awareness of how relevant data for a task can be collected b. plan a scientific task to collect relevant data 5 – 8 Marks	*Students can* a. show awareness of how valid and reliable data can be collected b. plan a scientific task to collect valid and reliable data 9 – 12 Marks
Principal Moderator comments:	*At this mark band candidates cannot produce any kind of a coherent plan, or draw an appropriate diagram.*	*At this mark band a simple description of a plan is all that is required. It may well be incomplete and / or inaccurate. Any simple diagrams may be inaccurate and /or incomplete.*	*At this mark band candidates normally provide a logical and fairly detailed account of their in class work and can sometimes apply the skills learned to a new situation. Any diagrams are normally sufficient to convey understanding and are labeled appropriately.*	*Candidates normally provide a very good account of their plan, and/or draw fully labelled diagrams in this mark band. They are clear about the meanings of validity and reliability. Candidates understand the need to change only the independent variable, and they know the reasons why readings are repeated, means taken, and how anomalous results should be dealt with.*

Extracting information and using data.	Students can only repeat information given without selectivity and make no further use of the data 0 Marks	*Students can* a. present data in a simple way b. identify simple patterns in data 1 – 4 Marks	Students can a. present data as instructed b. identify patterns in data using scientific ideas 5 – 8 Marks	*Students can* a . choose an appropriate method of presenting data b. identify detailed patterns in data applying relevant scientific principles. 9 – 12 Marks
Principal Moderator comments	*At this mark band candidates are unable to draw any sort of graph or suggest what any type of graph shows.*	*At this mark band candidates can normally spot errors in graphs, and / or complete simple bar charts. They can normally state what the graph shows in a simple way i.e. "as X gets bigger Y gets smaller", "the graph goes up" or similar.*	*At this mark band candidates can draw a simple bar chart, or complete a line graph using information from a data table. In addition to stating what the graph shows, they can normally say "the graph is linear", "there is a positive correlation" or similar, but with little or no further comment or explanation.*	*At this mark band candidates can normally correctly scale the axes of a graph, label the axes, plot the points accurately and draw an appropriate line of best fit. They can also explain terms such as directly proportional or inversely proportional etc., referring to the graph they have drawn, giving quantitative examples of the relationship shown.*

Interpretation judgement and opinion	Students can only repeat the information given and offer no relevant interpretation, judgement or opinion. 0 Marks	*Students can* a. draw a simple conclusion using data in an elementary way b. make a valid comment on procedures and / or results c. recognise a benefit and / or a drawback of a simple, familiar, scientific development 1 – 4 Marks	Students can a. draw a conclusion showing awareness of the appropriate science using data qualitatively and/or quantitatively. b. make valid comments showing awareness of the appropriate science c. recognise benefits and /or drawbacks of scientific developments 5 – 8 Marks	*Students can* a. draw conclusions showing detailed appreciation of the appropriate science, using complex data qualitatively and / or quantitatively. b. evaluate the strength of the evidence and / or suggest how validity and / or reliability of results can be improved. c. demonstrate a good understanding of benefits and /or drawbacks of scientific developments 9 – 12 Marks

Principal Moderator comments	*At this mark band candidates are normally unable to attempt any meaningful comment on data, text, or graphical information presented to them.*	*At this mark band candidates are normally able to offer a simple conclusion, and a meaningful comment on the method used or the results obtained. They can normally also give a relevant comment on a simple scientific development.*	*At this mark band candidates can normally explain a conclusion using relevant scientific understanding which may be either qualitative or quantitative. They can offer opinions on the results or graphs showing some awareness of the relevant scientific background. They can also discuss in a simple way the benefits and / or the negative aspects of scientific developments.*	*At this mark band candidates show a good understanding of the results, or graph, can go on to perform a complex calculation, and / or discuss in detail the finer points of a complex graph – ie the need to take more points around a peak or trough to be sure of the shape, etc. They can discuss where further evidence (ie more data points) is needed, or state giving reasons, if they think there is sufficient evidence for a firm conclusion. Given some data they can identify how validity and / or the reliability of the task can be improved. They can also discuss in detail the benefits and / or the negative aspects of recent scientific developments.*

Comments on each Section

Planning

Planning was tackled well by many students, although a significant number still fail to give sufficient details of their method – for Mark Band 4 there must be everything needed for a third party to accurately reproduce the experiment from the account provided. This means that all the details, including how variables were controlled, must be included.

Flawed procedures were described in a small number of instances, (e.g. Investigating Respiration) where the technique would not have allowed valid data to be collected. Invariably this was seen across the whole sample of scripts suggesting that it was not the fault of the students, but guidance they had been given collectively for completing the practical work prior to taking the IAA.

There has been a dramatic drop in the number of students who still have difficulty with the concepts of reliability and validity, and the number who confuse them. However, some centres are still awarding high marks for reliability where students say no more than "do three repeats and calculate the average." This lack of depth and clarity means that centres are often generous when marking this section. In Mark Band 4 students need to show some understanding of why repeats are useful i.e. to check that results are all similar (concordant), to look for anomalies or to remove or repeat results that do not fit the pattern. For validity, simple statements like "keep everything the same" or "make it a fair test" are not sufficient in Mark Band 4. Students will need to discuss which variables they need to control and how they need to control them. Some students are still drawing very poor diagrams which were more artistic than scientific.

Extracting Information & Using Data

Most students were able to spot errors in tables and complete gaps in averages, etc. It was encouraging to find a better understanding of the distinction between discrete and continuous data when it came to choosing which type of graph to draw. It is, however, interesting to see that more were able to choose the right type of graph than were able to explain why they had chosen it. In questions where students had to discuss their choice phrases like 'there were two sets of numbers' and 'it is easier to see the information with a bar chart' are still used. A few students still make improper use of the graph paper and this often prevents them achieving a high mark, as they are then unable to identify changes of gradient. Non-linear scales are also seen, and again this distorts the line and means that the patterns are not always obvious. Students do not need to start their scales at zero, but if they do not, they must indicate this, usually with two small parallel lines crossing the axis. In this instance, they must not take the line of best fit back through zero.

There were a number of cases of graphs plotted but with no lines drawn and a few cases where students seemed determined to draw a straight line as the line of best fit whatever the general trend of the points plotted. The fact that this was sometimes ticked and credited may indicate that they were following advice by their teachers. As part of the Mark Band 4 "identify detailed patterns", students are expected to discuss changing gradients, and if they have forced their line of best fit in to a straight line, they will be unable to do this.

Interpretation, Judgement & Opinion

This section of the IAA presents students with the greatest challenge, and this is usually reflected in lower marks compared with Planning and EIUD. There also tends to be a higher proportion of incomplete and unanswered questions in this part of the IAA: either because of an inability to answer them, or possibly due to lack of time. Some Centres marked rather generously, commonly annotating the work with words such as "implied" when the candidate has clearly not provided an answer in line with the banding proposed.

The same issues arise with reliability and validity in this section as in Planning. Some centres awarded high marks for very simple statements e.g. for reliability comments such as "repeat and average". Students cannot score in Mark Band 4 for these simple statements: they need to show an awareness of how the process of repeating can increase the reliability. This means that they must look at comparing their repeats in order to determine if they are concordant (the idea, not necessarily the term itself). This will depend on the nature of the experiment e.g. which differences can be considered slight, and which can be considered significant and are therefore anomalous. They then need to suggest what they might do with these anomalies, e.g. remove from the average or repeat again.

In the two IAAs where the precision of an answer was addressed, it was very rare for students to realise that they were making the data "more" precise than the equipment they were using! Students need to be encouraged to see that more decimal points does not necessarily lead to improved accuracy, and that processed answers can only be as accurate as the primary data they are based on.

Additional Comments on Individual IAAs

There was still a predominance of Series 4 IAAs, presumably because centres had used them last year with students. Within series 4 all of the IAAs were seen. Where series 5 were used there were definite favourites. These will be discussed individually.

Series 4 IAAs

Unit 5002 (Science -Biology)

Topic 4: This was the common of the two series 4 IAAs. This year saw an improvement in the method for the simulations on reaction time although some still students were still uncertain about this and so resorted to saying we used the "shooting sheep" program without giving details of how the program was used. Although the bar chart was plotted correctly, many students superimposed both pieces of data on the left of the *x* axis, rather than drawing Holly's reaction times on the graph to the right of Joe's reaction times. This was acceptable as long as each bar was very clearly labelled.

Unit 5003 (Science - Chemistry)

C1a Topic 6: In the planning section students had an idea of how to produce both soluble and insoluble salts but often missed out the details e.g. add excess magnesium powder to show complete reaction or wash the insoluble salt, lead iodide.

C1b Topic 8: In EIUD, the pie chart and the bar charts were completed well, with the vast majority of students able to discuss the scale as the reason for using two graphs for the data. Most students correctly chose a line graph, but the explanation was often left blank. Most

students were able to give advantages and disadvantages of drinking wine in terms of the resveratrol it contained.

Unit 5004 (Science - Physics)

P1a Topic 10: This was seen less often than Topic 11. Students seemed to find the diagram difficult to construct, especially the placing of the voltmeter. The graphs were completed well and all students were able to identify the anomaly in each of them. Students often became confused when comparing Peter and Naomi's data, and often contradicted themselves.

P1b Topic 11: This was the more popular of the two physics IAAs. Students were able to describe what they did, although the quality of the accompanying diagrams was variable. Many students calculated the averages, including the anomalies, even when they discussed reliability and said that anomalies should not be included in the average. This suggests repeating stock answers rather than really understanding what they were saying. A significant number of students did not understand how to increase the strength of the evidence. Instead they discussed how to improve reliability and validity. Again this suggests that students were answering the questions they expected to see rather than reading carefully. There was some confusion about which way to place the axes on the graph of angle A against angle C. The majority of students were able to discuss the advantages and disadvantages of the automatic window screen wipers.

Unit 5012 (Additional Science – Biology)

B2 Topic 1: This was the less popular of the two biology IAAs. This may be due to some centres' reluctance to use the maggots or to lack of suitable equipment. Centres that did try it gave their students a good opportunity to achieve high marks in Mark Band 4 because they understood the pattern of the graph and why there was a steep curve.

B2 Topic 4: These were answered well, with the majority of students able to plot and discuss both graphs. Students did, however, find it very difficult to relate these results to the question on soil quality. Many seemed to be answering a different question to the one posed.

Unit 5013 (Additional Science – Chemistry)

C2 Topic 7: There were some excellent discussions of the graph seen here. However, this seemed to be something they could either do or they couldn't: there were very few students who scored in the middle band for this.

C2 Topic 8: Students were able to recall their practical, but were often less able to plan the calcium carbonate experiment. Again, the simple statements 'repeat' and 'do a fair test' were seen. The first graph was well plotted and a suitable line of best fit drawn. Students tended to be very superficial when they compared their data with that given. "My scale was different" is an example of this. Students need to practise comparing results in preparation for IAAs.

Unit 5014 (Additional Science – Physics)

P2 Topic 10: There was some confusion about independent and dependent variables. All students were able to plot the extra data on the bar chart and spot the patterns. For the line graph many students chose to draw a straight line although the data does suggest a curve. This meant they were unable to discuss the patterns and draw conclusions in detail. The final page was not always well done, as students seemed to get confused when comparing Pauline's and Christine's data, and wrote the same answer twice.

Series 5 IAAs

B1a Topic 1: Where this was attempted, there was often a poor understanding of validity, and which variables needed to be controlled. This was also seen in the plans students wrote at the bottom of page 3. Centres are reminded that this IAA is about growth in duckweed and not directly about photosynthesis. Experiments on light intensity and bubble counting may not prepare students adequately for the rest of the questions in the IAA.

B1b Topic 3: There were very few seen this year. Where they were used, students found this difficult, and few were able to achieve high grades.

C1b Topic 7: This was one of the more popular Series 5 IAAs. On occasion, students did not appreciate what was required in the second method, and some did not vary the number of candles. Some students did not recognise that processed results could not be more precise than their original measurements. Many students struggled on the IJO section because they did not compare the two methods of preparing ethanol, as the question asks. Some outlined the two methods without offering some comparison, and others gave environmental advantages and disadvantages to burning fuels *per se*.

C1a Topic 5: A small number of centres used this IAA. However, many were confused about the second method, with many just giving the method for the practical that they had already completed. Those who gave the right method missed key parts e.g. washing and drying the copper precipitated in the reactions.

P1a Topic 9: Some good efforts were seen with this IAA. However, some students showed a lack of appreciation of the intended task. The task involved observing the decrease of voltage of a cell being drained as time went on. Statements like 'We increased the voltage after every minute', showed a lack of understanding of the task. There were, however, some good examples of high level lateral thinking seen e.g. suggesting that a disadvantage of additional features on a mobile phone (page 9) would be to make it '…more attractive to thieves'.

P1b Topic 12: Although there were few seen, this IAA was done successfully, with most students understanding clearly what was expected.

B2 topic 2: Most students did very well on pages 4 and 5. Then with some astute observations on page 6, and with the idea of more light at the top of the tree being focused upon than lower down, mark band 4 attainment was confirmed.

B2 Topic 3: For this, candidates were expected to use hydrogen carbonate indicator to investigate the rate of photosynthesis in pondweed. Some centres changed this to the more traditional 'counting bubbles experiment'. Students who did this then struggled in IJO when they were referred back to the hydrogen carbonate indicator and did not understand the question. Centres are reminded that they have access to the IAAs as part of their planning, so can see how the rest of the IAA is dependent on the correct practical.

C2 Topic 5: There were too few examples of this IAA seen to allow comment.

C2 Topic 6: With the graph on page 8, students should label the graph correctly with the tin on the left and lead on the right , however student can label the axes either way round, as both

are acceptable based on the information they are given in the rubric of the question. Once the graph is labelled, the rest of the questions must give answers deduced from it.

P2 Topic 9: Again, some centres adapted the method, with one centre doing a simple Hooke's law stretching spring experiment. Centres are reminded that the IAA is based on the practical as given in the Guidance For Teachers.

P2 Topic 11: There were too few examples of this IAA seen to allow comment.

Administration

The annotation of scripts continues to improve, although there is still a minority of centres who just tick. Centres which produced thorough annotation, to show why marks had been awarded, were generally in closer agreement with the moderators' marks. In some centres it is clear that the IAAs are being used as part of the student's formative assessment (AfL). These scripts with "student friendly" annotation to show links to criteria and targets for future work were very useful in showing the moderator how the centre had arrived at the mark. This good practice not only allows students to show progress in their IAAs but also aids the moderation process. The minimum requirement for moderation, however, is simple statements of band for example:

- "low band 3"
- "upper band 4"
- "just into band 2" etc.

Such comments should be added alongside the work, at the point of achievement. If sufficient of these annotated comments are made in each skill area, it makes the final judgement as to the overall quality of the work in each skill area much easier.

Evidence of internal moderation was seen and in many cases was clearly effective. However, care must be taken to ensure that standardisation is a dialogue between professionals and not just a remark by another teacher. Where work was "remarked", it was usually the second person's mark that counted. This is not true standardisation and means that the centre is dependent on the expertise of the second marker rather than allowing the sharing of good practice across the department.

In some Centres the questions on some of the scripts were given numerical marks, which were then aggregated to arrive at a total. This is an inappropriate procedure as it defeats the purpose of a generic grid, and is not recommended. Some centres are using their own 'mark schemes' that were wholly inappropriate to the specification criteria. In cases where there are two sections to each skill area, teachers must judge the quality of the work as a whole across both sections of the skill area.

Some Centres apparently did not give students the opportunity to do the recommended practical work before commencing the IAAs, and in some centres computer simulations or teacher demonstrations were used. Students who had actually performed a practical experiment, in general, performed better in terms of being able to plan and discuss improvements to the experimental design. This procedure also allows for variation in the quality of diagrams – those doing simulations invariably drew very similar diagrams. It is not recommended for students to draw the pieces of individual apparatus – we would prefer to see the assembled apparatus, with each item labelled.

Some Centres chose to alter the design of the experiments rather than follow those in the teacher guidance. This practise often meant that students were disadvantaged in other parts of the IAA. If a centre feels it is unable to complete a particular IAA then they should use another one in the series rather than adapt.

Full and detailed answers to the reliability and validity questions are the discriminators for band 4 marks, especially in the planning section. (Please refer to the glossary "Definitions of some Useful Scientific Words" published in February 2009 for full details of the meanings of the terms reliability and validity). When discussing reliability, most students were able to say "repeat the test", but many were unable to go on to discuss the treatment of anomalous results, the obtaining of concordant data, and the averaging of concordant results. To many students validity simply meant "fair testing", though many failed to expand on the meanings of these words, i.e. to discuss the controlling of all variables except the independent variable. Many centres still gave too much credit for answers that did not distinguish between reliability or validity and were too general.

For November 2011
The current set of IAAs (series 5) was published in June 2010. This is now the only set that will be available for the remainder of the life of the Specification.
The Controlled assessment tasks(CATs) for the new GCSE Science 2011 was released in June 2011

Further Support

- Centres are advised to make use of the free consultancy scheme for IAAs. Centres can send up to three marked IAAs per GCSE subject, (Science, Additional Science, Biology, Chemistry or Physics) to a Principal Moderator in order to receive advice on their standards of assessment. (Note - an updated Consultancy service document is now available via the 360 Science website).
- There is detailed guidance on series 5 IAAs that give centres an idea of the type of student responses expected within each mark band.
- There is a list of relevant in-class practical work available for Series 5 IAAS. Please see the 360 Science website.
- Teachers can continue to send in queries and questions via Edexcel "Ask The Expert" email service. These questions are normally answered within two working days by either the subject adviser at Edexcel, the Chief Examiner, or a Principal Moderator.
- There is a list of frequently asked questions (and the answers) relating to IAA issues on the 360 Science website. This was last updated in January 2009.
- There is written assessment guidance material available via the 360 Science website. Please see also the booklet "Internal Assessment Guidance for GCSE Science (2101) and GCSE Additional Science (2103)" published May 2008.
- "Definitions of Some Useful Scientific Words" (including the meanings of accuracy, concordant, precision, reliability, validity etc.) was published in February 2009 and is available on the 360 Science website.

Grade Boundaries

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