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Examiners' Report November 2010

Internal Assessment Activities (IAAs)

GCSE

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GCSE Science (2101)
GCSE Additional Science (2103)
GCSE Biology (2105)
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Principal Moderators' Report on Internal Assessments Activities (IAAs)
in GCSE Science, Additional Science, Biology, Chemistry and Physics
November 2010

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. Although this is a much smaller moderation window than the summer 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.

The majority of IAAs were Series 4 although there were a few from the new Series 5 for Chemistry and Physics. The majority were GCSE Science with only a few centres using this opportunity to present Additional IAA's. Most centres using the IAA papers from Series 4 and 5 have referred to the published guidance materials and this has helped them standardise across the disciplines. The annotation seen on many of the 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. This reflects the amount of time centres are putting into AfL and into ensuring that the students are adequately prepared for each IAA.

It was also very clear that in almost all centres, the advice relating to the carrying out of the suggested practical work had been used and that their students had benefited as a result. 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 'student 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 clarifies 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. In this moderation period all centres seen, sent relevant graphs attached to students 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 re-marked 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 work had not been 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 was more in line with the moderator. Centres are advised, in situations like this, to discuss the range of marks and reach a joint decision which 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.

Students (and unfortunately some teachers) continue to have difficulty with the concepts of reliability and validity and frequently confuse the two: some centres still awarded high MB4 marks when validity and reliability had not been clearly stated. Students should be encouraged to deal with the two separately even when they appear in the same section. If they separate them out when writing they may be less confused or likely to contradict themselves. Using side headings in long answer questions is a valid exam technique that students can be taught.

Some students are still drawing very poor diagrams which are much more artistic than scientific. Many students are still drawing an array of things all over the page in 3D, such as stop clocks, safety goggles etc. This is seen in questions where apparatus is asked for and students give a pictorial equipment list rather than show how the equipment is set up for the main part of their experiment.

Extracting Information & Using Data

It was encouraging to find a better understanding of the distinction between discrete and continuous data when it comes 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 owing to their inability 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 don’t, they need to 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 some students still seemed determined to draw a straight line as the line of best fit whatever the general trend of the points plotted. As part of the Mark Band 4 ‘identify detailed patterns’ students would be 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 still presents students with the greatest challenge and this is usually reflected in lower marks compared with P 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 a 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. Centres were awarding 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 discuss comparing their repeats and determining if they are concordant (the idea, not necessarily the term itself) within the remit of the experiment e.g. what differences can be considered slight and what are 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. 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.
In those IAA’s where the accuracy of an answer was addressed, it was very rare for the student to realise that they were making the data ‘more’ accurate than the equipment that they were using. Students need to be encouraged to see that having 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
Series 4 IAAs

Unit 5002 (Science - Biology)
B1a Topic 1: This was the most often seen of the two series 4 IAA's. Students tended to give very simple methods and did not go in to detail about randomising their quadrats or how they calculated things like percentage cover. The bar chart here was always well plotted and some students were able to give a mathematical slant to the pattern i.e. Garden C had approximately 4x as many daisies as Garden B or Garden C has more than twice the number of daisies than Garden A. Many sighted better conditions i.e. of sunlight and water as reasons but a few suggested that A & B might be mown more often so the daisies were less visible.

B1b Topic 4: Centres that used this IAA seemed to use more 'ruler dropping' experiments than computer simulation this time. Although the bar chart was plotted correctly, many students still 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, see comments earlier in report. 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 slightly more popular than in the summer but students still 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: 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.
There were very few Additional IAAs seen in this moderation period. Centres are referred to the Summer 2010 Principal Moderators report for details.

Series 5 IAAs
There were a limited number of Series 5 IAA's seen in this moderation period. These were predominantly C1a Topics 5 & 7 and P1a Topic 9

Unit 5003 (Science - Chemistry)
C1a Topic 5: A small number of centres used this IAA. Students did not always appreciate that the planning part of this IAA involves taking temperatures of exothermic reactions. In their plans to confirm the mass of copper formed most students did not mention washing and drying the copper precipitated in the reactions. The graph on page 5 often did not have any sort of a line joining the points.

C1b Topic 7: A small number of centres used this IAA. Students generally did well in Planning and EIUD but were confused by the final question in IJO. They tended to focus on how ethanol was made from ethane and from plants, rather than discussing the advantages and disadvantages of the two methods. When describing the pattern on the graph on page 5 few recognised that it takes approximately 4 seconds longer for every extra 100ml of volume in the jar. Candidates didn't recognise that you cannot be more accurate than your original measurement (this was also an issue in Series 4 see above). Some students' work did not include their own graphs with the IAAs; these were needed especially to assist assessing EIUD.

Unit 5004 (Science - Physics)
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. One student wrote 'We increased the voltage after every minute' showing they were not getting to grips with the task. There were some good examples of high level lateral thinking seen i.e. one student suggested that a disadvantage of additional features on a mobile phone (page 9) would be that it would make the phone '…more attractive to thieves'.

Administration
The annotation of scripts continues to improve, although there is still a minority of centres who just tick. Centres which produced thorough annotation linked to the guidance material were generally in closer agreement with the moderators' marks. In some centres it is clear that the IAA's 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 IAA's 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.
There were a number of centres were students had not written either their Centre Number or their Candidate Number on the script (or any extra sheets). This makes it difficult for moderators to identify scripts with similar names or where the handwriting is not clear. It also means that if scripts are separated i.e. for awarding, then it is more difficult to trace their centre.

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', the second mark was often higher and it was usually this that went on to the OPTEMS. 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.
Unlike the summer there was no evidence of questions being given numerical marks which were then aggregated to arrive at a total and there were fewer examples of centres using home made mark schemes. This meant that students work was being treated more holistically and this is in turn meant that centres were getting a better all round judgement of the work. 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 added lined paper for students to use when duplicating the IAAs – and as space on the papers is deliberately somewhat limited, this is an idea which deserves consideration by teachers and may depend to some extent upon the likely target cohort.

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. In a few cases it was apparent that some students had not completed the practical themselves and were on relying on a demonstration or secondary data. In these instances students often described a method that was unworkable, given the apparatus described. High marks cannot be awarded for an unworkable method.
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' 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 and validity and were too general.

For May 2011

The current set of IAAs (Series 4) was published in June 2009. This set is valid until May 2011.
The new set of IAAs (Series 5) was published in June 2010. This set is valid until May 2012.

Further Support

- Centres are advised to make use of the free consultancy service for IAAs. Centres can send up to three marked IAAs per GCSE science specification 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).
- Teachers can continue to send in queries and questions via Edexcel's '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.

Also Via The 360 Website

- There is detailed guidance on both the Series 4 and 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 both series 4 and series 5 IAAS. There is a list of frequently asked questions (and the answers) relating to IAA issues.
- There is generic guidance material available. Please see the booklet 'Internal Assessment Guidance for GCSE Science (2101) and GCSE Additional Science (2103)' published May 2008.
- Exemplar student work in Biology Chemistry and Physics IAAs, with moderated marks and commentaries.
  'Definitions of Some Useful Scientific Words' (including the meanings of accuracy, concordant, precision, reliability, validity etc.) was published in February 2009.

Grade Boundaries

Edexcel devised Internal Assessment units

Raw Grade Boundaries

	Max mark	A*	A	B	C	D	E	F	G
5001 5011 5024 5034 5044	18	16	14	12	11	9	7	5	3

	Max mark	A*	A	B	C	D	E	F	G
5002 5003 5004 5012 5013 5014	36	32	28	24	21	17	13	10	7

Uniform mark grade boundaries - All Units

Max UMS	A*	A	B	C	D	E	F	G
40	36	32	28	24	20	16	12	8

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