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# Examiners' Report Summer 2010

# Internal Assessment Activities (IAAs)
# Centre Devised Activities (CDAs)

GCSE

## 360Science

## GCSE Science (2101)
## GCSE Additional Science (2103)
## GCSE Biology (2105)
## GCSE Chemistry (2107)
## GCSE Physics (2109)

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Summer 2010

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# Principal Moderators' Report on Internal Assessments Activities (IAAs) in GCSE Science July 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. Most Centres have taken on board the advice given in training, the guidance materials for series 4 from the website, previous E9's, and the Principal Moderators' report from November 2009.

There was an even spread of series 3 & series 4 IAA's for both Core and Additional Science. This was the last time series 3 IAA's were available for moderation: from the autumn centres will be able to send series 4 and series 5. Most centres using the IAA papers from Series 4 have referred to the published guidance materials and this has helped them standardise across the disciplines. The annotation seen on series 4 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 IAA's 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 reflects 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 carrying out of the suggested practical work had been used and that their students had benefited as a result. A few centres chose to adapt the practicals, 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. 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 IAA's. 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 sent graphs attached to students' work, and this was an improvement on both last July and November.

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 this, 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<br>Performance not worthy of credit | Mark Band 2<br>Low level performance | Mark Band 3<br>Standard level performance | Mark Band 4<br>High level performance |
|---|---|---|---|---|
| *Planning* | *Students can*<br><br>*only give isolated facts not specifically related to the task under consideration*<br><br>*0 Marks* | *Students can*<br><br>*a. show some awareness of how scientific information can be collected*<br><br>*b. plan a simple scientific task*<br><br>*1 – 4 Marks* | *Students can*<br><br>*a. show awareness of how relevant data for a task can be collected*<br><br>*b. plan a scientific task to collect relevant data*<br>*5 – 8 Marks* | *Students can*<br><br>*a. show awareness of how valid and reliable data can be collected*<br><br>*b. plan a scientific task to collect valid and reliable data*<br><br>*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*<br><br>*only repeat information given without selectivity and make no further use of the data*<br><br>*0 Marks* | *Students can*<br><br>*a. present data in a simple way*<br><br>*b. identify simple patterns in data*<br><br>*1 – 4 Marks* | *Students can*<br><br>*a. present data as instructed*<br><br>*b. identify patterns in data using scientific ideas*<br><br>*5 – 8 Marks* | *Students can*<br><br>*a .choose an appropriate method of presenting data*<br><br>*b. identify detailed patterns in data applying relevant scientific principles.*<br><br>*9 – 12 Marks* |

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

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 one 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 were 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.

**Extracting Information & Using Data**

It was encouraging to find a better understanding of the distinction between discrete and continuous data and the corresponding use of a bar chart or line graph. A few students still make improper use of the graph paper, however, 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 also 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 were 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 staff to do this. 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 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 the two 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, which obviously shouldn't be done! Students need to be encouraged to see that more decimal points does not necessarily lead to accuracy and that processed answers can only be as accurate as the primary data they are based on.

**Additional Comments on Individual Series 4 IAA's**

Unit 5002 (Science -Biology)
Topic 4 was the most often seen of the two series 4 IAA's. The points raised earlier about simulations are pertinent here e.g. the mention of "shooting sheep" without 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 IAA's. 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 IAA's. 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 IAA’s.

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.

## 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 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.
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 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 some of those centres which had not actually performed the practical work, for example in the speed of sound experiment, the method described in the plan was wholly impossible, given the apparatus described, yet it was described as actually having been undertaken. These Centres awarded very high marks for a description that was invalid and patently unreliable.

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 2010**

The current set of IAA's (series 4) was published in June 2009. This set is valid until May 2011.
The new set of IAA's (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 scheme for IAAs. Centres can send up to three marked IAAs per GCSE subject, (Biology, Chemistry or Physics) to a Principal Moderator in order to receive advice on their standards of assessment.
- There is detailed guidance on both the Series 4 and series 5 IAA's 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. Please see the 360 Science website.
- Teachers can continue to send in queries and questions via Edexcel's "Ask The Expert" e mail service. These questions are normally answered within three 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.
- 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 Science website.

## Principal Moderators' Report on 360 Science Centre Devised Assessments (CDAs) Additional Science Units B2, C2 and P2 Summer 2010 Examinations Series

CDAs in GCSE Additional Science are one of three alternative modes of examination for B2, C2 and P2 units. CDAs in these units each count for 10% of the overall marks for the examination. Centres opting for this mode of assessment can choose up to three CDAs per candidate, (one from each of B2 C2 or P2), so this form of assessment can count for 10, 20 or 30% of a candidate's marks.

**Written communication**

Centres tended to be generous in this area, particularly at the upper end of the mark range. The assessment of the criteria was more accurate towards the lower end of the mark bands. To be awarded 7 or 8 marks, a candidate's work should have a clear logical structure. This means the candidate should set the scene for the whole assignment and link the parts together well. Words from the glossary should be integrated into the work at appropriate places and it needs to be clear that their meaning is understood. It was fairly common for candidates to provide a definition of words in the glossary (some of which were irrelevant to the task in hand) and then be credited with a high mark in this criterion.

It remains a concern that some weaker candidates are given credit by centres for using terms and phrases which they do not understand. Most students attained marks in the 3-4 or 5-6 ranges. Many were awarded 6 marks when only limited science had been used to explain the basis of their assignment.

Last year it was reported that some candidates appeared to have just been copied and pasted information from the Internet and that there was a clear distinction between this work and the candidate's own written work, particularly in terms of the style of language used. This practice was evident in some of the CDAs seen this year and remains a cause for concern. It is important that Centres award marks to candidates based on work which reflects their own ability and not on copied material. The reports presented in such cases were sometimes awarded high marks and were clearly disjointed and were made up of a compilation of cut and pasted clips from the Internet. The referencing of sources remains an issue for some candidates in some centres. The best practice is for references to be placed in the body of the report. This was seen more often than last year, but it is still not common practice as the regulations require. In the worst cases, there was no evidence of any referencing and it was evident that large chunks of text were not the candidates' own work.
Many candidates word processed their reports and were able to demonstrate the ability to produce clear, well structured work. Spelling and grammatical errors were reduced by computer programs.

**Analysis**

The full range of marks was seen, but Centres tended to be generous in assessing the analysis criterion for all three sciences and it was often difficult on moderation to justify any mark higher than 6. CDAs need primary or secondary data to be analysed, including a critical evaluation of the evidence, if they are to match the assessment criteria in the top mark band.
Many graphs were copied directly from a source including simple pie charts or bar charts, which last year were more likely to have been the candidates own work. These were used mainly to show the results of questionnaire-based surveys about recycling or the alloys of gold. Line graphs were only usually seen in the P2 'smoke alarms' CDA; most of these concerned radioactive decay curves for americium-241. Only a very limited amount of numerical analysis of data was seen in the CDAs this year. In many CDAs this area continues to be one of weakness because of a lack of inclusion of the candidate's own evidence together with an original graph.
Where data was analysed most students could identify trends and patterns in their data and draw simple conclusions. However, many candidates were given credit in the 5-6 mark band when they had not clearly explained conclusions using scientific knowledge, e.g. a simple description of random disintegration and constant half life for the americium-241 decay curve. Detailed descriptions of patterns, noting changes in rates for instance, may go some way towards mark band 4 performance. In general, CDAs based upon questionnaires were poorly discussed.
Many candidates were confused by the distinction between reliability and validity, and it was rare to see these terms discussed clearly in relation to the data. In addition, the implications of results

were not usually examined. Hence, marks in the top band could not often be supported on moderation. Where data was taken from secondary sources, there was often little application of scientific knowledge and understanding; this was particularly true in the Gold task where candidates did not comment on the process of producing alloys or the relevance of allergy to Nickel.
There were a number of instances were the students presented no data at all for analysis which made it difficult to award any marks at all for this criterion on moderation. This is a worrying situation that needs to be addressed, especially when it is due to the Centre's CDA design.

**Applications and Implications**
Overall, Centres were generous in their assessment of this criterion for activities involving each of the three sciences. The skill of argument, discussion and giving an opinion was not evident in the work of some candidates. Centres need to consider how they should inform candidates on how to present today's view of 'modern science in education'. Although some high marks were awarded by Centres, they could not always be justified on moderation. Many students just gave a list of advantages and disadvantages of an application or implication of science without discussing these points or showing any understanding of the underpinning science. In many instances these advantages and disadvantages were identical across the Centre, implying a class discussion or a resource sheet used by all. Such lists could not be called 'reasoned arguments for and against applications and implications of the science', so it was difficult to award marks in the 5-6 band. Most candidates found it easy to argue for an application such as recycling, uses of gold in jewellery or the installation of smoke alarms, but found the counter argument much more difficult. However, many did not discuss the scientific implications of an issue in any great depth. Centres are advised that the scientific implications have an equal weighting with the arguments for and against a particular point.

Candidates need to gain all the criteria for mark band 5-6 in order to be considered for the award of 7-8 marks. To get into mark band 5-6, the statements need to be well reasoned, though marks were often given when this was not the case. The substantiated conclusions needed to gain 7 or 8 marks were rarely seen.

**Consultancy Service**
A free Consultancy Service is available for centres considering using this mode of assessment for either the Additional Science or the separate science extension units. Centres devising their own tasks may either send in a draft version to a named Principal Moderator, or alternatively a small sample of completed, marked tasks can be submitted to check the standard of marking prior to the submission of the work for moderation.

Full details of this service are on the Edexcel 360 Science website (secure download).

**Examples of CDAs seen this year:**
As in the first year of this mode of assessment, the vast majority of Centres used the exemplars found in the guidance material provided by Edexcel.
For Unit B2 the most popular task was 'Recycling'. Some moderators did not see examples of the 'Stem cell' CDA. It was noted that candidates who attempted the 'Recycling' task were not always able to use an appropriate level of science knowledge, including words from the glossary, to justify some very high marks awarded.

For Unit C2 the most popular task was 'Plastics' followed by 'Gold'. Centres are asked to note that in the Plastics task some considerable polymer science, with the correct use of glossary terms, is required to access the highest mark bands.
Those candidates who attempted the 'Gold' task often failed to discuss the concept of alloying in any sort of detail. Candidates generally found this task difficult.
The science behind both of the tasks is important and must be evident for the award of high marks.

For Unit P2 the most popular task was 'Smoke Alarms' followed by 'Braking Distance' or 'Nuclear Power'. Scientific explanations for the radioactive decay curve are expected for the smoke alarm

task, which should consider the random nature of radioactive decay. Some candidates did not include a decay curve or other relevant data and so struggled with Analysis in particular.

Some centres provided candidates with a structured format requiring answers to be given to a list of questions based upon provided data. This is not a recommended strategy for more able candidates since this approach limits achievement, although it is more appropriate for less able candidates.

As mentioned in the 2009 report, information relating to the CDA was not always provided by Centres. This made it very difficult to judge the amount of assistance given to candidates, and hence made the moderator's job much harder. Centres are respectfully reminded that moderators do need to see assignment briefs, information sheets and transcripts where appropriate and these must be included with the candidates' work.

The design of the CDA tasks can allow for a range of methods of presentation. The written report was the most popular, but some candidates explored other methods of presentation, such as booklets, PowerPoint presentations and posters. The standard of ICT skills seen was excellent in many cases. However, Centres are advised that some styles of presentation are not appropriate for more able candidates as they may restrict their ability to satisfy all parts of the assessment criteria. A print-out of a PowerPoint presentation may not reflect the full ability of candidates, e.g. what was discussed whilst the presentation was being made, and does not usually provide the moderator with all the evidence needed to moderate work accurately. Therefore, it is very important that these submissions are accompanied by a transcript of the notes used by the candidate to accompany their presentation to aid moderation.

The level of annotation varies from centre to centre. There were some excellent examples of annotation seen this year, that clearly identified where a candidate had been awarded a mark. In cases where there was confusion, the annotation was expanded to justify the award of the mark. In other centres there was little or no evidence of why the centre had awarded a particular mark from the criteria. In consequence a considerable amount of moderator time was spent in looking for marks which the Centre had awarded. Centres are respectfully reminded that internally assessed work should be annotated using at least minimalist notation such as WC 5, A 6 or AIS 4. Notes such as these placed in the margin, at the point of achievement, are all that is required. Additional detail justifying the award of particular marks is optional, but of immense help to moderators when they read through scripts and try to support Centre marks. The practice in some Centres was to write a brief summary explaining the reason why particular marks were awarded for a criterion. This summary was usually at the end of the work or on a separate sheet. Whilst this was of some value, many comments tended to be too general to assist moderation and specific points of achievement were not identified.

There was little evidence of effective internal standardisation as was the case in previous years. Centres are reminded that this is very good practice and a comprehensive system of internal standardisation should be in place. More thorough internal standardisation is likely to identify and clarify the differences between the Centre's markers in the accuracy of applying the assessment criteria and also result in agreement between Centre and moderator being more likely.
When it is not obvious that internal standardisation has been carried out, moderators would appreciate a brief note from Centres to indicate what has taken place.

**Plagiarism**
Plagiarism was an issue that affected some candidates in some centres. This was less seen than in 2009, but teachers must be ever mindful of this possibility. It has been a concern that candidates might download material from the Internet and simply pass it off as their own work and this remains an issue for some centres. Whilst candidates are encouraged to use the Internet as a valuable resource in preparing work for CDA tasks, they must acknowledge the source, preferably in the body of the text, and they must not copy and paste paragraphs of work pretending it is their own. It is acceptable for the use of a sentence or two (at most) to be used, but quotation marks must be placed around the downloaded material and it must be properly referenced. Centres are respectfully reminded that in situations where candidates cannot be trusted to undertake this type

of task responsibly outside the classroom, then the work must be completed under the teacher's guidance in the centre .

**Summary**

Some work was seen which was exemplary in its assessment however even fewer centres produced their own assessments. Edexcel strongly encourages teachers to develop their own material, possibly using exemplar material as a framework and adapting it to make good use of the local environment and to maximise the potential of the candidates in their Centres. The design brief needs to point towards some opportunity for data to be collected and analysed, otherwise the candidates will be disadvantaged.

In some Centres, mark schemes had been devised for specific CDA assignments. Where centres used these rather than the generic assessment criteria, there were sometimes significant mark differences between the Centre and the moderator. Some of these schemes did not fully encompass the generic criteria and consequently Centres disadvantaged their candidates. The situation could have been avoided had the Centres used the free Consultancy service in advance of submitting work for moderation.

It was pleasing to see that in some Centres the assessment criteria had clearly been shared and discussed with students before assignments had been started. This raised candidates' awareness of how they should approach their task in order to maximise their performance. Many of the most successful Centres also used sub-headings in the design of their assignments to cue appropriate responses. This approach is perfectly acceptable as long as candidates are not given undue assistance.

Very good practice was seen in some Centres where teachers had marked carefully, standardised work effectively and annotated scripts using points from the assessment criteria. This was most useful to moderators in helping to support teachers' assessments.

## Principal Moderators' Report on 360 Science Centre Devised Assessments (CDAs) Extension Units B3, C3 and P3 Summer 2010 Examinations Series

CDAs in the extension units count for 30% of the overall marks for the examination. They are an alternative to the one hour extension papers in each of the B3, C3 and P3 units. CDAs in these units are expected to produce work of comparable standard to the alternative written paper.
Centres choosing this option are required to produce portfolios of candidates' work totalling 108 marks. The portfolio may be put together in a number of ways, ranging from four separate tasks at 27 marks each, to one holistic task allowing for up to 108 marks. There are a number of other possible combinations, of course. The maximum marks available for an individual CDA task are 27, 54, 81 or 108, depending on the amount of specification coverage.

**Consultancy Service**
Edexcel offers a free Consultancy Service for Centres considering using the CDA route of assessment for either the Additional Science or the separate science extension units. Centres may either send in a draft version of their task to the appropriate Principal Moderator for their Centre. Alternatively they may send in completed, marked tasks so that the standard of marking may be checked prior to submission of the work for moderation. Full details of this service are on the Edexcel website (secure download).

Some centres continue to devise their own mark schemes which related specifically to the task assessed. Where centres used these, rather than the generic criteria, there were sometimes significant mark differences between the centre and the moderator. Some of these Centre mark schemes appeared to be selective in choosing which of the generic criteria should make up a certain mark range. Consequently candidates were disadvantaged.

**Examples of CDAs seen this year:**
The majority of Centres used the exemplars provided by Edexcel in the guidance material.

For Unit B3 the most popular tasks were 'Biotechnology' and 'Behaviour'.
For Unit C3 the most popular tasks were 'Chemical Detection' and 'Esters'.
For Unit P3 the most popular tasks were 'Gas Laws', 'PET Scans' and 'Endoscopy'.

Some centres provided candidates with a structured format requiring answers to be given to a list of questions based upon provided data. This is not to be recommended for more able candidates since this approach limits candidates' achievement. For less able candidates, however, this type of approach may be more appropriate.
In a number of instances the assignment briefs were not provided by the centre. This made it very difficult to judge the amount of assistance given to candidates and hence made the moderator's job much harder. Centres are respectfully reminded that moderators do need to see assignment briefs, relevant information sheets and notes used when candidates have delivered PowerPoint presentations.

The design of the CDA tasks can allow for a range of methods of presentation. Written reports were the most popular, but some candidates used other methods of presentation, such as booklets, PowerPoint presentations and posters. In some cases the standard of ICT skills used in presenting was excellent. Some styles of presentation, such as posters, are not recommended for more able candidates, as they may restrict their ability to satisfy all parts of the assessment criteria. Where PowerPoint presentations are submitted, centres seldom provide supporting notes to the slides, these would assist the centre in providing evidence of some of the detail that is sometimes missing from the slides, which in some cases are little more than headings and very brief notes. In such cases there was also a lack of referencing of sources. Candidates should acknowledge sources alongside the places where they are used. This could be done by candidates annotating their printouts of slides afterwards.

There were fewer instances of work being presented that was not related to the specification. For example, the Boyles Law task in P3 was replaced by tasks relating to the Pressure Law which

is better connected to the specification. However there were still a few centres that did present topics that were not part of the Extension specifications.

The quality of annotation varied from Centre to Centre. Some excellent practice was seen where teachers had annotated work at the point of achievement, using quotes from the assessment criteria. Centres are reminded that internally assessed work should be annotated using minimalist notation such as AO1 8, AO2 6 and AO3 7 at the point of achievement in the work. Any additional detail as to reasons for the award of marks is optional and at the Centre's discretion, but very helpful to moderators who are trying to support Centre marks. Some Centres just provided a summary sheet for each candidate; this was helpful to get an overall picture of teachers' assessments, but it did not help with moderation when it came to individual mark points.

Evidence of effective internal standardisation was variable. In some cases the only evidence that internal adjustments had been made was by the crossing out of the original teacher's marks. It would have assisted moderation if an explanation for their differing awards had been made at the point of reference in the body of the text. Careful internal standardisation is likely to identify and clarify the differences between teachers within a Centre in terms of how accurately the assessment criteria are being applied. This should also make agreement between Centre and moderator more likely.

It was pleasing to see that in some Centres the assessment criteria had clearly been shared and discussed with candidates before assignments had been started. This raised candidates' awareness of how they should approach their task in order to maximise their performance. Some Centres also used sub-headings in their assignments to cue appropriate responses, such as 'analysis', 'evaluation' or 'suggested improvements' for AO3. This approach is perfectly acceptable as long as candidates are not given undue assistance.

Words from the glossary should be integrated into the work at appropriate places and it needs to be clear that their meaning is understood. It was not uncommon for candidates to provide a definition of words in the glossary (some of which were irrelevant to the task in hand) and then be credited with a high mark in AO1.

The work was presented in various fashions. Punched pages held together with a treasury tag would be preferable to slippery plastic pockets, sometimes stuffed to bursting with unnumbered loose leaves. Very few centres ensured that the candidates used page numbers; this would be best practice. In a few cases there was little to identify the students work apart from the cover sheet, the name of the student was not on the following sheets, so the work of students could easily be muddled up.

**Plagiarism**

This remains a cause for concern from some centres and is very much centre dependent. Moderators saw evidence of work from some candidates where downloaded material from the Internet was simply passed off as their own. Whilst candidates are encouraged to use the Internet as a valuable resource in preparing work for CDA tasks, they must acknowledge the source, preferably in the body of the text, and they must not copy and paste paragraphs of work pretending it is their own. It is acceptable for the use of a sentence or two (at most) to be used, but quotation marks should be placed around the downloaded material and it must be properly referenced. Sources, which were frequently from the Internet, were often named but not always at the point of use. In situations where candidates cannot be trusted to undertake this type of task responsibly outside the classroom, then the work must be completed under the teacher's guidance in the Centre - see FAQ 1 in 'Exemplar centre devised internal assessments with guidance part 2' (November 2007). Where moderators had cause for concern regarding plagiarism the work sent to the Compliance Unit at Edexcel. There were fewer incidents of this type this year compared to 2009.

In **Biology Unit B3**, little originality or innovation was seen in 2010. The work seen for the 'behaviour' topic was generally more interesting for both candidates and moderators than work seen for the 'biotechnology topic.

By far the most popular B3 CDAs moderated were Diabetes and Animal behaviour. Very little of anything else was seen. The Diabetes work sometimes included BMI and diets. The majority of work seen was in the form of a written report, but a few PowerPoint presentations were seen; these were usually of an inferior quality to the written reports. A number of very good coherent accounts were seen, showing good integration of research into the reports. However, it is still very apparent when chunks of information have been copied and pasted into work. Some excellent referencing within the text was seen, but this was not commonplace. Many students just write a bibliography (at best) and do not indicate where the sources have been used. High quality work tends to be seen in Centres where teachers are fully au fait with the assessment criteria and where the students have been taught the relevant sections of the specification. In some Centres it seems as though the extension unit CDA is a means to an end; it is set as a research assignment and does not involve teaching of the relevant material. This is not recommended.

Annotation was variable. In many cases it was unhelpful as it did not always relate to the assessment criteria. This may be because teachers still have problems in unravelling the criteria and in assigning accurate marks. It was apparent that teachers in some Centres do not fully understand what is expected of students in terms of producing a high quality portfolio.

In **Chemistry Unit C3** the majority of Centres used the exemplars from the Edexcel Guidance Booklet part 2, with their candidates carrying out the "Chemical Detection and Hard Water" task for Topic 1 (marked out of 81) and "Esters" for Topic 2 (marked out of 27). A small number of Centres used four separate tasks, each marked out of 27. Some of these tasks had been designed by the Centres, e.g. 'Fertilizers' and 'Electrolysis and purification of copper' and did not allow candidates easy access to the full range of marks for each criterion.
Practical work in the chemistry CDAs gave candidates the opportunity to collect primary data for themselves. This also gave them the opportunity to discuss validity and reliability. However, some Centres closed down these tasks by giving very prescriptive methods rather than allowing candidates to extend their own work.

Overall, many candidates' did not perform particularly well in this part of the examination; they generally followed assessment briefs to the letter and there was often a lack of original thought or enquiry. Another major problem was the acceptance of material from Internet sources being correct and beyond question as to its validity and reliability.

In **Physics Unit P3** much of the work presented fulfilled the specification requirements and the criteria well and there was good evidence that the exemplar material on the website had been referred to wisely. However, the quality of work seen particularly in PET scanners and in 'seeing inside the body' was sometimes limited, with little variation from one candidate to another in the Centre. There was often little evidence at the top end of the mark range that indicated that there was comparable quality of work to that expected from candidates at the top end of the terminal paper for P3. The PET scan task still gives many centres difficulty in gaining high marks in AO3 as there is little scope for real data analysis and data interpretation. Many centres awarded a high mark for quite poor outcomes. This may be addressed by experiments or simulations concerning the absorption of gamma rays or the half-life of a radionuclide. The Gas Laws task used by many centres was able to provide good levels of attainment in AO3, however some centres struggled to provide evidence of AO2 as examples of benefits and risks and ethical issues were either briefly dealt with, or were inappropriate, or simply left out. Some centres undertook tasks relating to Endoscopy, the practical tasks that were used within these were not always well linked to the use of Endoscopes.
**AO1 (Knowledge and understanding of science and how science works)**

Centres were sometimes too generous in awarding marks in the upper band. To score 7 to 9 marks considerable detail is required in the candidates' work. Some Centres awarded marks in this band even though there was a lack of detailed scientific knowledge and understanding of 'How Science Works', which should have encompassed the principal concepts investigated. In the 'Diabetes' CDA candidates rarely mentioned issues such as how research plays an important role in the diagnosis and treatment of the condition such as the cloning of the Human Insulin Gene and/or the use of Stem Cell research. In the behavioural tasks there was a lack of breadth of coverage of the learning outcomes in the specification. In the 'Esters' CDA many candidates failed to acknowledge that esters are present in cosmetics and are used to make emollients. Candidates also did not appreciate the need to use the most appropriate equipment and techniques available for practical work, e.g. the use of burettes to determine the amount of soap solution required to produce a permanent lather. High attainment was achieved by many students with the Medical Physics / PET scanning work. However sometimes there were omissions which meant that very high marks for this area could not be supported. Students' discussions of N-Z graphs were often quite brief and there was variability in the depth they went into on the principles in practice behind PET scans. With the Gas Laws task students need to focus a little more on particle ideas to explain the gas laws, especially with regard to explaining pressure more fully.

**Application of skills, knowledge and understanding (AO2)**
As in AO1, Centers were generous in awarding marks in the upper band. Higher level marks demand that candidates demonstrate good understanding of the benefits and risks of scientific advances, and identify ethical issues related to these. If this is not present then these marks are not accessible. When considering ethical views candidates should arrive at their own conclusions. Sometimes there was a balance of views put forward with extensive quotes but no summation of the candidates' own view. In many cases Centres did not give opportunities in the tasks chosen, particularly when they had been developed 'in-house', for candidates to look at sensible benefits and risks and identifies relevant ethical issues. This was apparent in a CDA about electrolysis and the purification of copper. For B3 the Behaviour task gave similar issues to centres, students find it difficult to link their knowledge to applications of relevant science, e.g. methods used to train animals. Identifying relevant ethical issues tends to be a more accessible aspect of AO2, but this is just one aspect of the criteria and too much emphasis seems to be placed on this by some candidates. The problem could have been avoided had the centre used the consultancy service before moderation. In P3, the main benefit of PET in identification of tumours was often stated. The risk of radiation affecting DNA and starting tumour growth was sometimes stated. Some students put forward very effective reasoning in terms of the ethical choices that need to be made within a health service provision. For instance, some compared the costs of PET scans with other scanning techniques or alongside what such money could do in terms of treatment, e.g. kidney dialysis.

Centres were found to have marked reasonably accurately in the lower range of ability.

**Practical, enquiry and data-handling skills (AO3)**
This criterion requires candidates to have experienced some practical work and to have collected and analysed data. The data could be taken from a secondary source such as a website, but has to be interpreted and discussed. Centres that selected appropriate tasks scored well in this section. Where a practical activity had been planned that gave data and allowed access to the criteria there was generally good agreement between Centre and moderator. Some tasks did not provide candidates with the opportunity to collect appropriate data. Some physics (5050) coursework submissions lacked higher achievement due to deficiencies in A03 attainment. The key there is for students to provide critical evaluations of their evidence. This is most easily facilitated by primary experiments e.g.; the investigation of the effect of temperature on the pressure or volume of a fixed mass of gas, or the variation of pressure and volume for a fixed mass of gas at constant temperature, or at various constant temperatures. Experiments relating to total internal reflection and can be applied to the use of optical fibres in medical physics. The inverse square law can be investigated for a light source to model X-rays. All these experiments generate data, are relevant to aspects of P3 and can be

used to provide direct experimental evidence towards AO3. However it is recognised that this is not always possible, especially with regard to radioactivity data. Where this is used students should ask themselves 'What are the assumptions the model / simulations is based upon?' Clearly they should be permitted to enquire of others in this connection, including their teachers. They could repeat a simulation and see if it gave precisely the same data. They could compare data from different sites / software packages. All of this, together with focussed reflection, will aid their achievement.

The collection of relevant scientific ideas comes into AO1 but it does not represent the evidence/data that are needed for AO3.
Some B3 CDAs generated fairly basic data and only allowed simple conclusions to be drawn. Questionnaires are commonly used in biology CDAs but they do not usually allow candidates to develop sophisticated responses in AO3. Practical work in some B3 CDAs only generates fairly basic (and often only qualitative) data which only allows simple conclusions to be drawn. However, good practice was noted in one Centre, where a colorimeter had been used to analyse the results of tests for glucose using Benedict's solution.
An issue across all three sciences was the ability of candidates to suggest suitable improvements to their methods and to distinguish clearly between accuracy, reliability and validity. Comments on reliability were usually limited to repeating measurements or tests and the validity of tasks were rarely addressed adequately. There was also a lack of evaluation on how strongly their evidence supported their conclusions. Consequently, marks were sometimes limited to the 4 - 6 band at best.

As with AO1 and AO2, it was generally much easier to support Centre marks from the middle band downwards.

**Summary**

As in 2009, there was some work that was exemplary in its quality and assessment A few centres continued to produce innovative work which built on the exemplars in the Edexcel guidance material. Teachers are encouraged to develop their own CDAs to make good use of the local environment and to maximise the potential of the candidates in their Centres.

Centres are strongly advised to review their assignment briefs to ensure that candidates are given the opportunity to access the full range of marks in each criterion. In particular, candidates need to be able to collect suitable primary and secondary data so that AO3 can be tackled effectively.

Moderators appreciate the hard work that goes on in Centres, but receiving samples which has been thoroughly annotated and internally standardised makes it much easier to support Centre marks.

# Grade Boundaries

## Edexcel devised Internal Assessment units

### Raw Grade Boundaries

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

| 5002<br>5003<br>5004<br>5012<br>5013<br>5014 | Max mark | A* | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|---|
| | 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 |

## Grade Boundaries

## Centre devised Internal Assessment Units

Raw grade boundaries

| | Max mark | A* | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|---|
| 5021<br>5022<br>5023 | 24 | 22 | 20 | 18 | 16 | 13 | 11 | 9 | 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 |

## Biology, Chemistry and Physics Extension units

## Raw Grade Boundaries

| | Max mark | A* | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|---|
| 5030<br>5040<br>5050 | 108 | 90 | 80 | 70 | 60 | 49 | 38 | 28 | 18 |

## Uniform mark grade boundaries

| Max UMS | A* | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|
| 120 | 110 | 98 | 86 | 74 | 61 | 48 | 36 | 24 |

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