Version 1.0: 0809

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Applied Science 8771/8773/8776/8779

SC07 Planning and Carrying out a Scientific Investigation

Report on the Examination

2009 examination - June series

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Set and published by the Assessment and Qualifications Alliance.

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General Comments

The number of candidates entered for the portfolio units has again increased this year and many centres have continued to guide their candidates to achieve well. These units have generated much high quality work from centres. Credit should be given to both teachers and candidates in making considerable effort to meet the expected standards.

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The random sampling of accredited centres confirmed the value of the accreditation process - with centre marking being confirmed as being in line with AQA standards in most cases, but with a small number showing some "slippage" leading to loss of accreditation.

(The accreditation scheme is used were centres have demonstrated that they are able to mark to the required AQA standards. Under the scheme AQA will accept centre marks without the need to complete the moderation process.)

Portfolio issues

Portfolio construction remains a concern with some candidates, and it is evident that further centre guidance is needed. However, it is very important that centres continue to provide the opportunity for candidates to demonstrate flair and individuality. It is easier for moderation if portfolio structure matches the structure of the unit. Centres are also advised to monitor portfolios during their production as some candidates continue to produce unreasonably large portfolios.

For some units, it appears that the level of expectation of the quality of portfolio content and/or the outcomes that candidates are able to produce are set too low. A number of centres are still judged to have marked candidates work too generously and where this was the case, centres marks were deemed out of tolerance by the moderator and had to be reduced.

Some of the causes of overgenerous marking included:

- Misinterpretation of the requirements of unit
- Too much work on non-essential areas and/or too little on required aspects
- failure to fully complete aspects of the unit as required in the "Banner", in such cases work should assesses in line with the guidance given in section 9.2 of the teachers' guide
- Over-lenient interpretation of the assessment grids
- Lack of rigour in marking/assessment of work – incorrect science accepted, incorrect calculations marked as correct, incorrect statements accepted, praise for work which is of poor quality, marks allocated for work for which there is no evidence – or no supporting teacher comment (# in the assessment grids)
- Poor candidate skills in practical activities leading to a lack of precision and unreliability in results
- A lack of description by the centre assessor of candidate's level of practical skills, their awareness of safety procedures and degree of autonomy (marked # in the assessment grids) and resulting inconsistencies between the marks awarded by the assessor and the portfolio evidence
- The inclusion of materials down-loaded from the internet either passed as the candidates own work or not referenced in the portfolio

As stressed at AQA standardising meetings held in autumn 2008, in communications sent to centres and in last year's Principal Moderators report, it is imperative that centres make it very clear to candidates that the incorporation of text downloaded from the Internet into portfolios is plagiarism and must not be tolerated.

Centres are reminded that many issues and points of guidance made in the 2008 Principal Moderators exam report are still valid and this remains a valuable source of information for centres seeking to improve there portfolios.

Unit 7 – Planning and Carrying out a Scientific Investigation

The portfolios seen this year demonstrated various approaches and methods of delivery of the unit specification. Some investigations based on links between centres and scientific organisations, companies or university departments were in evidence; the use of a real client who set specific, realistic and relevant objectives for the investigation generally provided an excellent starting point and candidates frequently responded well. Where such links are unavailable, centre led investigations with a hypothetical client can work well - provided the objectives are realistic and the degree of centre direction is not significant. Additionally, the provision of scenarios that allow candidates to develop investigations with a level of demand firmly set at A2 in terms of both the practical methodology and the associated scientific principles is ideal. The depth and breadth of approach are equally important: some investigations are still submitted where the work is simply a sub-set of another unit, for instance SC12, SC16, or SC13.

Where centres provide a single investigation topic for the whole group, this can compound problems, as it is occasionally more efficient for the centre (time, materials, facilities) if candidates all follow identical approaches, with the same (centre determined, even centre issued) standard procedures. This tends to constrain candidates, especially those aspiring to the high mark bands, and it can compromise the approach to some assessment criteria when the methodology and the outcomes are all, in effect, pre-determined. This can manifest itself in various ways. For instance, candidates only research one practical method (the one they will be using), ignoring other, perhaps more accurate, methods which could have been identified had candidates tried to research methods rather than relying on what they had been advised to use. Alternatively, candidates may research two or three practical methods, but only trial and adopt one, not necessarily the most accurate or reliable, without any scientific justification or real explanation for the choice.

Sometimes, where candidates are given a wide choice, or even a free choice, it is necessary for the centre to advise and guide so that the level of demand, the objectives, the depth of treatment, etc are appropriate. Whilst some of the more extreme cases of low levels of demand seen in previous years did not reappear in 2009, there were still a number of investigations set by centres where the level of demand was barely GCSE level. This often provided scant opportunity for candidates to move beyond the lower mark bands; particularly where the nature of the “data” obtained was purely subjective or qualitative.

Good practice evident in a range of portfolios this year included:

- A realistic client and realistic objectives. (Realistic objectives do not really include those where the findings can simply be looked up in literature, on the Internet or, indeed, on the packet or carton! A very contrived client and objectives, strongly centre led, with predetermined methodology and, sometimes, outcomes is unrealistic and constrains candidates opportunities to access higher mark bands)

- Extensive research into the proposed standard procedures, the background, and supporting scientific principles and health and safety issues
- Validation of secondary sources
- Risk assessments that were well set out, explained and show some consideration of health and safety guidelines and legislation
- A high level of understanding of the scientific basis of the chosen area and it is was clear that the candidate understood how scientific principles were applied to the investigation
- A comprehensive plan or research outline including the nature of experiments, standard procedures with modifications (where appropriate) pre- and post trialling, complete risk assessments *(a time-line or sequence of activities is often a useful addition to this)*
- Correct calculations appropriate and of a high level of precision including full working and explanations - in AO2, up to 12 marks are available and so calculations make a significant contribution to the final mark awarded
- Evidence of extensive trials with results, together with a full explanation of how standard procedures are to be modified to allow the investigation's objectives to be met
- Observations and measurements that were complete, and presentation logical and precision and units appropriate
- Analysis of data, good construction of relevant graphs or charts and appropriate conclusions drawn to match the evidence
- Evaluation of the methodology, a description of qualitative errors, and the equipment used, including quantitative errors, and an appreciation of the accuracy of results obtained, are all well considered
- A clear, logical and well structured report
- A separate presentation of the findings to the client, which conveyed all the relevant information relating to the original objectives and indicated the scientific basis for the conclusions

Some specific areas of weakness that continue to limit marks for some candidates, and should be considered in future entries include:

- Lack of demand of activities, both in terms of the scientific basis for the investigation and the adopted methodology
- Insufficient research into the scientific basis of the chosen area of study and possible standard procedures
- Unrealistic clients and objectives
- Contrived scenarios, which lead to a considerable degree of centre prescription including pre-determining the outcomes
- Clients who readily have access to the information required from known, pre-existing sources making the basis of the investigation unnecessary
- A lack of practical skill evident from results that lack precision, concordancy, and accuracy
- A lack of realisation that volumetric analysis stands or falls on the accuracy of the standard solutions used. Failure to standardise solutions, even those which are well known to be problematical such as DCPIP, sodium hydroxide, iodine and hydrochloric acid, which results in inaccuracies in final data
- Group work that can lead to unreliable results. Some practical tasks are simply not appropriate for "combined efforts" and do not allow an individual's skill levels to be assessed. Combining results where data are recorded to different levels of precision or reliability can compromise an individual's own results due to inaccuracies by others

There appears to be a number of centres where investigatory work undertaken by candidates suffers from issues out of the control of candidates which makes their opportunities to gain marks and to operate successfully more difficult. These are centre issues and compromise student marks and standards of attainment and – as a result - final outcomes.

Some of the problems identified and which place unfair barriers to student progress included:

- Failure to provide sufficient apparatus for activities
- Failure to provide operating instructions for apparatus to facilitate use
- Provision of out of date solutions or ingredients
- Provision of incorrectly standardised or incorrect strength solutions
- Allowing unethical or environmentally unsound activities to be undertaken – putting snails into strong acid solutions (as “acid rain”) is environmentally unfriendly and patently cruel
- Setting investigatory work well above the knowledge levels expected in the specification making the work out of context and too challenging
- Setting work at inappropriate times of the course – time limits too short or inappropriate times of the year
- Expecting or allowing candidates to produce too much work – massive portfolios are not necessary, take too long to produce and read and are not helpful for anyone – teacher, candidate or moderator

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA Website.