



**General Certificate of Education (A-level) Applied
June 2012**

Applied Science

SC07

**(Specification
8771/8773/8776/8777/8779)**

**Unit 7: Planning and Carrying out a Scientific
Investigation**

Report on the Examination

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General Comments

(Centres are advised to read and act on their own personal feedback reports on the unit entries made this year).

Centres are to be congratulated for preparing students well for the units in this award, and, as in previous years, some very high quality work was evident, resulting in good grades.

An increase in the use of Assessment Objective (AO) based mark grids by centres to support marking has been evident, and some centres (but by no means all) have also included good supporting annotation, including carefully checking calculations, identifying downloads and responding in detail to the requirements (marked #) for teacher evidence to support marks awarded. Conversely, some centres have no mark grids, no break-down of marks in AO3, little supporting annotation or any indication of having marked the scripts. Whilst many centres used mark grids appropriately and clearly cross referenced the descriptors with the portfolio evidence, some centres' use of mark grids indicated that marks had been applied very leniently and the significance of key words ('comprehensive', 'complete', etc) did not appear to be understood or were not applied appropriately.

A worrying trend is an apparent increase in the use of group work for the collection and recording of data which is subsequently used for calculations. Sometimes it seems that candidates have not carried out significant levels of practical work on an individual basis. In these cases, moderators have found some difficulty in determining candidates' levels of participation and the contribution of the individual to practical work. This made supporting centre assessments of candidates' abilities and skill levels more difficult in these centres. At its extreme, there was evidence that some practical work in some centres was little more than teacher demonstrations, making it almost impossible to award marks based on clear evidence for some assessment strands.

There is also clear evidence from some centres of increased levels of teacher guidance and direction. This is to be expected in a teaching context, but when producing portfolio evidence, over-guidance and over-direction of candidates' work detracts from opportunities for candidates to demonstrate their own skills. Over-guidance is often seen in the form of issued templates, or similar, for calculations. In such cases, candidates are unable to provide evidence of the application of their own knowledge and understanding and marks may be limited accordingly. Unfortunately, this style of centre approach can affect able students most. Candidates who find work challenging may be helped by 'scaffolding' sheets and work should be marked appropriately. However, able students may not actually require the help and may thus be marked down (by the centre) for help that was not required.

In most units there is a high demand for research, and material is often being cut and pasted and not reworked. SC01, SC04, SC06, SC07, SC12 and SC15 are particularly affected but so, on occasions, are others. Some candidates have openly acknowledged and referenced a large amount of downloaded material and their portfolios can have large sections which are little more than an accumulation of downloaded segments, referenced but not reworded by the candidate. Unfortunately, some centres have made no comment on this practice and awarded very high marks, giving the impression that they think it is acceptable. In a few cases, it has become apparent that centres are guiding candidates via the provision of extensive materials on a 'virtual learning environment' section of the centre website which is not accessible by moderators. Similarly, the availability of booklets, pamphlets and other written materials in centres which provide excessive levels of guidance needs to be questioned with regard to their effect on autonomy and research.

Centres can expect moderators' requests for clarification of the centre approach in this regard and for provision of details or examples of specific materials which students have used.

Risk Assessments (RAs) are an integral part of all units apart from SC01. The standard of RAs is widely variable, but few candidates actually manage to target all the materials used in terms of amounts and, crucially, state and concentration. As a result, the subsequent hazard identification can be wrong. Correct hazard identification, precautions for safe working, control measures and disposal are also appropriate to include. Some portfolios contained page after page (up to 16 pages for a single experiment have been seen) of simplistic considerations of the hazards associated with glassware and the like, often repeated several times where repeats or similar activities were carried out using the same or very similar materials. These are not necessary. However, for microbiology-based experiments, e.g. SC07, SC12, SC15, detailed risk assessments for investigations using bacteria of various types are very important, but these are often neglected or sparsely treated. Sometimes candidates mis-name bacteria and use the names for pathogenic forms when (it is hoped) non-pathogenic strains have been used. There seems to be the impression that school laboratory strains of bacteria are without risk. In fact a number of candidates actually stated this, when clearly it is not the case. All cultures should be treated as potentially pathogenic, since contamination could have occurred.

In most units, mathematical skill assessments are made. It is noted this year that there appear to be some weaker mathematical skills evident from some candidates and this goes across the mark ranges. It is really important that candidates are guided in the appropriate collection, presentation and processing of data. Where calculations are undertaken, the appropriate formulae should be displayed, the logic of calculations explained and the sources of numbers made clear. Appropriate precision should be used and values should be quoted to the appropriate number of significant figures. Candidates should be encouraged to consider the significance of any values calculated and where percentage error values are calculated, these should be used and related to the experimental values found. To simply calculate percentage errors and not use them in any way indicates a lack of appreciation of their significance. Candidates should consider the best way to display data using graphical techniques. They should show correct choice of scales, correct axis labels, correct units, correct plotting of points, correct lines of best fit, and anomalous points should be identified and ignored for line construction. Graph lines should not be double, 'jagged' or kinked if meant to be straight. A line of best fit/curve should be the line that best fits the pattern shown by points, ignoring clearly anomalous values. All these skills are expected and candidates should be guided in these conventional graphical techniques during the course.

Some centres seem to be unaware of what constitutes MB4 work, and are awarding high marks for work attributed to different assessment objectives when there is little in-depth quality science evident. Centres are advised to compare their portfolios with exemplar and standardisation materials, and/or consult their portfolio adviser if they are uncertain, but, clearly, a correct sub-heading with just a few lines of basic content will not be worthy of marks in the higher mark bands. For consideration in MB3 and MB4, work has to demonstrate both depth and breadth and demonstrate understanding commensurate with high grades at GCE Advanced Level. This must be borne in mind at all times and for all strands in each assessment objective. Marks awarded consistently in MB4 are likely to be representative of a good 'A' grade candidate's work. Centres are advised to consider whether marks at this level are realistic when considering the overall picture of work seen and the likely performance of particular candidates.

Accredited centres can sometimes demonstrate a degree of 'drift' in marking standards, and there may have been changes in the assessor for individual units. This 'drift' is apparent for some centres which were part of the random sample of accredited centres, not all of which are found to be in tolerance. Accredited centres are advised to monitor the standards applied throughout the accreditation period and it would be worth considering obtaining and examining the most recent teacher standardising materials for the appropriate units prior to assessment of work and submission of centre marks.

Format of portfolios

AQA does not specify how portfolios should be constructed. However, experience has shown the following points will be of use to candidates:

- Construction to match specification unit layout aids coverage of the required aspects of study by candidates, and can help avoid omissions of required aspects.
- Use of sub-headings to match specification requirements aids coverage and helps to produce a logical progression through the work.
- Over-large portfolios are problematic. A number of centres continue to produce very large portfolios despite being given advice that this is not good practice. These portfolios take students far too long to produce, make monitoring, review and draft marking very time consuming and make moderation overly lengthy. Production of large portfolios can demonstrate an inability of the candidate to decide what is and is not important to include and can be a measure of the candidates' Quality of Written Communication (QWC) skills. Centres are requested to discuss portfolio construction with candidates and determine what a reasonable size is; a portfolio should not simply grow as students find more and more potentially relevant information but should be well constructed, containing relevant and sufficient details to cover the unit well but not becoming unmanageable.
- It would aid candidates' QWC if they fully checked their portfolios before submission. Many have duplicated pages, pages out of sequence or inverted, pages not numbered, work not proof read or spell checked. Many also need to learn the correct use of superscript and suffix functions on their computers.
- Plastic A4 wallets (poly-pockets) are not acceptable. It is best to secure portfolio pages by treasury tags. The use of numbered pages should be seen as a routine matter.
- Word-processed portfolios are much easier to read than handwritten documents. Candidates should balance legibility against font size and line spacing, use of double sided printing, 'white-space' and resultant effect on portfolio size.

Comments on Individual Unit

Centres should note that reports for previous years are still available on the AQA website and that their content is still valid, as the same concerns are evident every year in a small number of centres.

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Investigation contexts range from very extensive microbiological work producing comprehensive results, to analytical work based on redox titrations, to energy efficiency of wind turbines and its relationship to blade cross sections and angles, to trans-esterification of oils and the investigation of the properties of biodiesel, and many more. Many candidates are producing portfolios with high levels of evidence, extensive data showing good precision, accuracy and reliability, all set in a realistic context fully in keeping with the demands of an A2 level science. Unfortunately, some centres continue with investigations that sometimes do not even reach GCSE standards in terms of methodology and others which produce results which are never likely to be precise, accurate or reliable. In a small minority of cases, extensive centre guidance is evident, sometimes across all the components of the investigation, and this can limit marks significantly.

Validation of sources: it is often difficult to ascertain what information has been used from the sources for the investigation. Candidates often need guidance as to what is meant by 'validation'.

Health and safety and environmental issues and the explanation for their necessity are often missed out. Candidates need to consider the relevant legislation and then apply this to the consideration of issues relevant to their investigation and then go on to write risk assessments.

Candidates often failed to justify their trials and it was difficult to ascertain how some trials linked into the original purpose of the investigation or why exactly they were performed. In some instances, where trials were performed, no modifications were made to standard procedures, but there were clear and obvious areas in need of modification (e.g. concentrations, times, temperatures) in order to generate accurate and reliable data. Again, a centre-led approach was evident in some cases.

The presentation to the client was sometimes a cut and paste event from the main investigation and not adapted to meet the needs of the client. Candidates used a limited range of methods for presenting the outcomes of the investigation to the client, and, often, they gave no thought to the geographical location of the client, their scientific background, or the best medium to use and the levels of scientific language to employ. Clearly, the central issues are the objectives, the outcomes and conclusions and recommendations, but these are not always made clear.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the [Results Statistics](#) page of the AQA Website.