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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Applied Science 8771/8773/8776/8779

SC03 Finding out about Substances

Report on the Examination

2009 examination - June series

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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 3 – Finding out about Substances

Many centres have an excellent approach to this unit, with appropriate practical tasks that meet the criteria set in appropriate vocational contexts with clear objectives. Some centres still provide tasks with no real context and no obvious final objective; in these cases, candidates seem to be going through the motions of following standard procedures, but to no obvious purpose. In these cases less able candidates tend to struggle to draw valid conclusions and evaluate their findings.

There are some areas of the assessment grids which remain problematic across a range of centres such as:

- The applications of the techniques in an industrial setting (see Specification for an outline list on which portfolio content can be based)
- The limitations of the qualitative techniques (i.e. the qualitative analysis and chromatography) in AO1 – see 2008 Report
- Evaluation of methodology and data obtained in AO3(ii). This is a relatively high level skill and candidates need to be taught how to approach aspects such as a consideration of qualitative and quantitative errors. Too many evaluations are still very low level, GCSE style at best, and comment more on the candidate's own practical inexperience rather than the results obtained, the procedures used and the conclusions drawn.

A typical high scoring portfolio seen this year had the following content:

- All five required investigations completed to a consistently high standard
- Good vocational contexts for the exercises with specific objectives
- Good supporting comments from centre assessors concerning skill levels, safe working and autonomy (#)
- Full, detailed coverage of all the required criteria – uses, limitations (of qualitative techniques), scientific principles of the techniques, precision, accuracy, calculations, recording, risk assessments, standard procedures, analysis of results and conclusions, evaluations

A typical high scoring portfolio will contain the following:

Qualitative Analysis

- Standard procedures (including how the sample is prepared for testing) for a range of cation and anion tests, including flame tests, precipitation tests with aqueous sodium hydroxide (and, often, aqueous ammonia), carbonate, halide and sulphate tests
- A range of possible results for the tests, followed by an analysis of a suitable unknown or unknowns
- Good scientific terminology and accurately described test results
- Uses and limitations of the technique described

- Full risk assessments indentifying hazards, risks and control measures for the substances and concentrations used

Volumetric Analysis

- Scientific principles of acid/base titrations
- Preparation of a standard solution
- Standard procedure and full risk assessment (aimed at the substances and concentrations to be used)
- All raw data included to appropriate precision (+/-0.05 for all burette reading and titres), identification of concordant results and calculation of mean titres
- Correct calculations where it is clear from the candidates' explanations and working that they understand the principles
- Comparison of the candidate's result with the expected or teacher value (# please provide teacher/assessor evidence where required)
- Evaluation of both qualitative errors and quantitative errors

It is worth pointing out that one titration, completed well, is likely to score higher marks than several titrations with variable results, precision and accuracy

Colorimetry

- Scientific principles of colorimetry and relation of absorbance to concentration; an outline of how a colorimeter works
- Standard procedures and risk assessments. How samples are prepared for use
- Preparation, via serial dilution, of a range of standards and measurement of absorbance leading to a calibration curve. Excellent graphical work
- All raw data tabulated, good precision, units, etc
- Measurement of an unknown of suitable dilution
- Conclusions based on the concentration of the unknown found from the graph Comparison with the “expected” result (# please provide teacher/assessor evidence where required)
- Evaluations, including reference to the graph, line of best fit, scatter, anomalies, etc

Chromatography

- Good levels of understanding of the scientific principles, mobile and stationery phases for a variety of chromatographic types and (rarely) partition of solutes between phases. Rf values explained
- Standard procedures and risk assessments for all substances used including the components of the solvent used
- Paper or thin layer chromatograms (actual, photographs or accurate schematic diagrams of the results)
- Identification of the components in an unknown based on R_f values obtained for those components in comparison with an appropriate range of known substances
- Evaluation of methodology and outcomes
- Typical scenarios that seem to work well for a number of centres include, identification of an unknown/banned food additive, identification of amino acids, lipids, etc

Enthalpy of Combustion

- Explanation of the meaning of the term enthalpy of combustion, scientific knowledge of the origin of enthalpy changes in terms of bond making and breaking, energy level diagrams for exothermic and endothermic reactions
- A completed standard procedure and risk assessment
- Fully tabulated results with correct levels of precision and units
- Correct calculation of molar enthalpy change
- Consideration of the usefulness of combustion reactions, e.g. fuels
- Theoretical molar enthalpy change from mean bond enthalpies related to previous consideration of energy level diagrams and applied to the substance tested
- Comparison of theoretical and experimental values, and full evaluation of qualitative and quantitative errors

Mark Ranges and Award of Grades

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