A-LEVEL
CHEMISTRY

CHM6T Investigative and Practical Skills in A2 Chemistry
Report on the Examination

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Administration

Moderators are once again very grateful that the majority of schools and colleges submitted a complete, well-presented sample for moderation by the 15 May deadline.

There were some common issues with materials submitted for moderation from a smaller number of schools and colleges. The following points are a summary of these:

- Schools and colleges with entries of twenty or less do not require a sample selection but should instead send the work of all students directly to the moderator by the deadline.
- Full completion of the front page of the ISA Written Test means that there is no need for students to complete an individual Candidate Record Form.
- Teacher results **must** be supplied with the material sent to the moderator.
- Schools and colleges with more than one student group should clearly indicate which teacher result applies to each individual student.
- There were a significant number of addition and transcription errors. Schools and colleges are strongly advised to ensure that students' marks are correctly recorded, totalled and entered because not all errors can be rectified by the moderation of a sample of work.
- It is vital that tasks are trialled by the school/college well in advance of the students completing them. This helps to prevent anomalous results that may cause students difficulties later in the ISA. Where difficulties are encountered, schools and colleges must contact their allocated Assessment Adviser.

Finally, AQA publishes the **Instructions for the Administration of the ISA** in order to make clear to all schools and colleges the requirements for security of the ISA material. It is expected that all schools and colleges follow these instructions. Schools and colleges who fail to follow these instructions can expect to be investigated.

The mechanics of marking

Moderators try to support the marking of a school or college, where possible. It is much easier to support marking when the instructions in the **Guidance for Teachers marking Chemistry ISAs** have been followed. Markers are reminded that this section should be read before any work is marked. The following points should be noted.

- Place a tick as close to the correct point as possible.
- One tick should equal one mark.
- Underlining, not crosses, should be used to highlight incorrect material.
- Place the total for that question or part question in the margin - even if this is zero.

Consistently following the above allows for easy checking by teachers and the moderator. Inconsistency leads to incorrect addition and transposition errors.

Internal standardisation must be carried out where schools and colleges have multiple teaching groups. When work is marked by more than one teacher during internal standardisation, it should be made clear on the work which is the final agreed mark.

Marking

The majority of schools and colleges were able to apply the published Marking Guidelines successfully and accurately. However, the standard of marking was often less secure in *How Science Works* questions.

Accurate marking requires the following:

(a) When the answer in the Marking Guidelines includes specific chemical terms or phrases or underlined words, these words, or their very close equivalents, **must** be present if an answer is to be credited. As a simple example, if the answer is 'white precipitate', a mark cannot be allowed for 'the mixture turns white' or 'the solution turns cloudy'.

(b) When two elements of an answer are linked together by an underlined 'and', **both** elements must be present for the answer to be credited. For example, if the answer is 'temperature and pressure' the student must mention both temperature and pressure to earn the mark.

(c) A mark **cannot** be awarded when a student's response contains chemical errors alongside the correct answer. To continue with the example in part (a), the answer 'a white precipitate of magnesium nitrate' is not worth a mark.

(d) Where benefit of doubt is applied, the response must be close to the expected response and it is useful if the judgment is annotated on the paper by the marker. Where a number of these judgments appear on a paper there must be a balance between ones where the criterion has been allowed and not allowed.

The Marking Guidelines cannot cover all possible answers and it is inevitable that teachers will be faced with a range of additional responses. Some schools and colleges had difficulty with marking when answers differed from those published. Marking here was often inconsistent; correct chemistry that did not precisely follow the Marking Guidelines was often penalised while answers of little merit were often credited. Again, the allocated Assessment Adviser can support teachers by providing guidance on applying the Marking Guidelines. However, they cannot be asked to prime-mark specific student responses.

CHM6T/P14: Task

This task was similar to a previous EMPA practical task. The majority of schools and colleges were able to produce high quality, consistent results. A few schools and colleges struggled and found a spread of student values. This underlined the importance of care and attention being paid to the setting up of the initial mixture. The volumes were relatively small but, in the trials for this task, consistent sets of concordant values were invariably seen. It is important to note that a lack of attention to the simpler skills in any exercise, at whatever level, will render results inaccurate and it should be stressed to students that diligence at all stages is vital. This exercise is also prone to problems if the mixtures are not kept for at least a week, are not mixed thoroughly or are kept in a different place (with possibly a different ambient temperature from the one used by the teacher). There were also some very high and very low titres seen. This further emphasises the need for an early trial of the task so that help can be sought from the Assessment Adviser if needed.

CHM6T/P14: Written Test

This paper proved accessible to students and a good number of scripts with high marks were seen. The main problem areas are given below.

Section A

The steps leading up to the calculation of K_c for the reaction appeared well known and were successfully tackled by many students and good marks were common in Questions 1 to 6. The usual problems arose on moderation for a few schools and colleges, such as allowing averaging of all titres in Question 1, failing to spot that students had not multiplied by 10 in Question 2, allowing one significant figure answers in Question 3(b), failing to spot incorrect substitution of values, ignoring wrong units and significant figures in Question 6.

In Question 4, a few schools and colleges allowed answers relating to absorption of CO_2 from the atmosphere, ignoring the Additional Guidance given in the Marking Guidelines.

In Question 7, many students failed to mention that more than one mixture would be needed initially since the procedure does not directly allow for small samples being removed from the equilibrium mixture. Responses here were also often lacking in detail and clarity.

Question 8 also proved to be a very difficult question for many students for similar reasons to Question 7 (ie the need for clear expression of chemical logic). Many students referred to the changing of the actual position of equilibrium in the original mixture, not the diluted solution. Most students appreciated that the acid would be more dilute but did not see that it would appear that more acid had turned into ester. This logic was incorrectly rewarded fully by a few markers.

Section B

The graph in Question 9(a) was quite complex and required attention to detail. Notwithstanding this, some very good examples were seen. Unfortunately, the standard of marking was not as good with many markers failing to spot missing points, misplots and poor lines on the linear section in the middle of the graph. This last point was vital for good answers to Questions 9(b) and 9(c). Scale was not an issue on this graph although a few decided to ignore the instruction to start at pH 4. Quite a few students assumed that the first point was anomalous.

Questions 9(b) and 9(c) proved more troublesome than expected. Some students were unable to process the information and gave the neutralisation titre (accurately) in Question 9(b). Quite a few had a pK_a of 9.0 but then lost marks giving one significant figure answers to the second part of Question 9(c). Often this was not penalised by the marker.

The key point in Question 9(d) was the recognition that swirling or full mixing of the solution had not occurred and some answers were not thought through fully as they implied that the pH should be lower and not higher than expected. However, many good answers were also seen.

The marking of Question 9(e) was often lenient and students were allowed to suggest that the whole experiment should be carried out with the addition of very small volumes from the start. This is neither practical nor a slight modification; it must occur near the end point. Quite a few students were incorrectly rewarded for this.

The answers to Question 10 appeared familiar to most students but their ability to produce fully correct answers was variable. There were many instances where the potassium dichromate had not been acidified, was given the oxidation state of (IV), had an incomplete colour change stated and wrong/incomplete formulae for reagents. These errors were not always penalised by the marker. It should be noted that the Fehling's or Tollens' tests can be used but that it must be clear that an aldehyde is being distilled off correctly from the mixture first.

CHM6T/Q14: Task

Some schools and colleges had difficulty in obtaining all of the expected observations in some of the tests in this task. It is expected that teachers should know what observations should occur but this was not always the case. All schools and colleges are reminded to trial the task before the students complete it and to consult with their Assessment Adviser if a test (or more than one test) does not produce observations that would be expected.

A number of schools and colleges do not seem to realise that the teacher results for an observation exercise provide a check that the correct solutions have been given to the students. Teacher results are not an opportunity to increase the number of creditworthy answers. The moderator will accept a teacher alternative as long as it is reasonable. If the great majority of students in the group obtain the expected result, the teacher result will be ignored. The Marking Guidelines allow for reasonable variations but moderators will not use teacher results that are completely out of line with the expected observations. A common error is to note a 'red solution' where the shade of the solution is red-brown or orange-red; this is not allowed.

Many students continue to struggle with recording their results in an observation exercise. The Additional Guidance in the Marking Guidelines covers many of the non-standard answers. This guidance is periodically updated and expanded, and teachers must be aware of the changes when marking scripts. A significant number of schools and colleges were very generous when marking this task, accepting loose descriptions instead of the correct chemical terms. Also, if the student records an additional, incorrect observation then this will cancel a correct observation and lose the scoring point for that test.

CHM6T/Q14: Written Test

This option was less popular than the CHM6T/P14 option, possibly because of the time constraints on teaching and practical at the end of the course. Students generally coped confidently with the early questions in Section A but struggled at times with the detail needed in the later questions. Answers in Section B were often disappointing. It was also noted that answers were often seen in the Written Test that contradicted the observations the student had made – this then lost marks on moderation even where it matched the Marking Guidelines (for a 'normal' observation).

Section A

Question 1 was generally well done by students but there were some instances where errors in formulae or charges were not penalised by markers.

Question 2 required some thought and an appreciation of the chemical ideas behind the formation of the vanadium(II) state. The pressure mark was well understood but students found it difficult to express clearly the need for hydrogen to remain in the tube or for air to be expelled. Despite this, there were too many cases where both marks were awarded.

The manganese chemistry in Question 3 was well appreciated but uncertain students often gave a list of possibilities that should have been penalised by the marker on the 'list principle'. Only the higher-scoring students were able to predict the relevant observation based on their knowledge of iron(III) chemistry in Question 4 and there was a significant failure in Question 5 to relate students' own observations to the theory given; only a reiteration of the information in the equation was seen. Many students gave the identity of the precipitate as iodine.

The diagrams given for the half-cell in Question 6(a) were occasionally poorly labelled and, too often, leniently marked. Full names or formulae of suitable iron(II) and iron(III) compounds must appear when the term 'reagent' is requested. In a few cases, students giving iron(III) sulfate as one reagent failed to realise that 1.0 mol dm^{-3} solutions of this would give double the ion concentration required. When only one reagent was given, this was penalised but the concentration mark could still be awarded and this was sometimes harshly treated by some teachers. Question 6(b) was well understood by many but the use of 'movement of electrons' appeared occasionally and was not always penalised.

In Question 7(a), the students' own observations should have been checked with many having formed an orange solution (and been rewarded since the teacher result also showed this). The answer here should then have been $Cr_2O_7^{2-}$ and for Question 7(b) 'no further change' would have been expected. This point was missed by many markers.

In Question 8(a), there were many good answers seen but only the highest-scoring students were able to appreciate the mole ratio required in Question 8(b). Some teachers assumed a mistake had been made and marked 3 mol correct.

Section B

Lots of correct answers were seen for Questions 9(a) and 9(b) but part (c) caused many more problems with sketchy answers sometimes being credited with full marks. It was not clearly understood that a method for determining the point at which the copper(II) concentration was 0.5 mol dm^{-3} was needed. Calorimetry was a common error. A novel approach was to wait until the cell potential had fallen to half its original value but this is incorrect chemistry and so should not have been credited. This is a good example of where reference to the Assessment Adviser would be helpful.

In Question 10(a), there were many examples of full marks being awarded for vague, unclear or confusing answers. Unless the student makes it very clear which type of cell they are referring to in their answer they cannot gain full credit. Lenient marking was often seen here. The ideas in Question 10(b), however, were well understood.

Despite the long catalogue of points listed above, this was, overall, another very positive session in many schools and colleges. The new administrative arrangements were applied well and schools and colleges are thanked for this. Teachers in schools and colleges have, in the main, successfully and securely delivered the practical assessment and have impressed with the accurate and consistent standard of their marking. In my first report as Principal Moderator, I am grateful for the opportunity to salute their professionalism and thank them for their integrity.

Mark Ranges and Award of Grades

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

Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.

UMS conversion calculator