

# A-LEVEL CHEMISTRY

CHM3T Investigative and Practical Skills in AS 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:

- 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'.
- 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.
- 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.
- 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.

## CHM3T/P14: Task

High task marks were again common for this titration exercise. An occasional problem for students was the school or college making a mistake with one of the reagent solutions resulting in a very low or a very high titre value. In such cases, it becomes difficult for students to score well for accuracy. Teachers **cannot** increase the tolerance boundaries for the accuracy marks. Once again, it must be emphasised that **the task must be trialled before the students undertake it**, even if the exercise is routine.

A complete results table will require three columns for 'Initial volume' (even if zero), 'Final volume' and 'Titre'. It was surprising how many students still record the initial reading of a burette as 50 cm<sup>3</sup>. The marker must check that the student has calculated an average titre correctly and has only used concordant results in the calculation. A subtraction error by the student can have a significant effect. In addition to the loss of the recording mark, the student may also lose the concordancy mark and suffer a reduction in the mark awarded for accuracy. If the error is overlooked by the marker, the discrepancy in the mark awarded for the task may easily take the

marking of the student's script out of tolerance. Accuracy marks are based on the correct average titre. If the student does not have two titres within  $0.20 \text{ cm}^3$  of each other, then no marks can be awarded for accuracy.

A few teachers, having realised that the task value was unrealistic, arbitrarily and incorrectly gave their students a teacher value for use in the Written Test. Teachers are reminded that a teacher value should only be given to students with no task results at all. Such students cannot then be awarded any marks for the task. Schools and colleges are reminded that if something goes drastically wrong with a task, they must contact their Assessment Adviser or the Subject Team at AQA for guidance **before** the students attempt the Written Test.

### CHM3T/P14: Written Test

This paper proved marginally easier than last year but a wide range of marks was seen. Students usually completed the calculation questions in Section A confidently but performed less well in Section B, especially with procedural questions. It must be stressed that the majority of teachers were able to apply the Marking Guidelines and mark accurately. The long list of problem areas given below is mainly intended to help the inexperienced teacher or those new to the AQA scheme.

#### Section A

In Question 1, students should not have been awarded the mark if they included a non-concordant titre in the average. Two titres are concordant if they are within  $0.10 \text{ cm}^3$  of each other. When overlapping concordant results are seen, the student is expected to select **any** set that are concordant for the average.

In Questions 2, 3 and 4, some teachers did not penalise students who gave answers ignoring the precision requirements stated in the Marking Guidelines. This was especially the case in Question 3. There is a general lack of understanding of the concept of significant figures. These calculations were, however, well done by many students. The follow-on Question 5 was also completed well by many students but the exact method used often varied from that given in the Marking Guidelines. It should be noted that chemically valid methods can be credited; it is not possible to show all variants in the Marking Guidelines. Some teachers did not allow any method that differed from that given, even if logically correct.

In Question 6 and in many of the sections in Question 8, a large proportion of the marks were often awarded for imprecise and vague comments, even those that were specifically excluded in the Marking Guidelines. It was clear from students' responses that many students find it difficult to express chemical ideas logically and clearly. It was not seen as a language issue but more the inability to order their chemical logic appropriately.

In Question 8, marking was frequently too generous. In Question 8(a), stating that the titre volume would be affected was insufficient and in Question 8(b) the context of swirling the contents of the flask was frequently absent but a mark was given. For Question 8(c)(i), answers did not always make it clear that 'washing' returned reagents to the flask and in Question 8(c)(ii) statements implying there is no change in the number of moles should not have been credited.

Question 9 was generally answered well but a few markers did not realise it was only a 1 mark question and some ignored arithmetic errors in the various calculations. These should be carefully

checked since the final answer depends on them. The higher-scoring students were able to complete Question 10 easily but a few markers did not realise that if M1 had been lost then M2 could still be accessed if the incorrect volume had  $10 \text{ cm}^3$  subtracted.

## Section B

In Question 11(a), most students completed the graph successfully. A number of students did not appreciate the significance of the origin in this type of experiment. Some teachers were generous when awarding the mark for drawing a line of best fit. In graph plotting questions, where the points contain one or more anomalies, the line of best fit must ignore these anomalies to score the mark. The line of best fit mark cannot be awarded when the line itself is poorly drawn or doubled in places. There was some evidence for poor checking of the graphs by teachers, particularly on misplotted points. Question 11(b) caused few problems.

As with Question 5, Question 11(c) could be approached by a number of routes but some markers were reluctant to allow any answers that varied from the Marking Guidelines. Chemically valid alternative answers are allowed, as stated in the Guidance for Marking ISAs document included at the front of the Marking Guidelines for each ISA.

Question 12(a) was generally well done but in Question 12(b) far too many markers allowed the explosive nature of hydrogen in air. The Marking Guidelines specifically required the idea of pressure build up but this was frequently ignored. In Question 13, the corrosive nature of KOH was well known but it was often necessary to apply the 'list' principle to additional incorrect points given by the student.

In Question 14, the equation was difficult but often completed well. In the test for ammonia, the requirement for a **complete** indicator colour change and for the student to make it clear that the test was not being done on the solution were areas of lenient marking.

## CHM3T/Q14: Task

The task involved a set of observations on a sample of magnesium sulfate solution prepared by the students. There were some reported problems in a few schools and colleges with an over-vigorous reaction during the preparation and with a brown precipitate appearing in the silver nitrate test. Where teachers contacted their Assessment Adviser or the Subject Team after trialling the tasks, any problems could be alleviated. It is again worth reiterating that all schools and colleges are strongly advised to test the tasks with the materials required, well in advance of the students. All difficulties cannot be predicted by AQA, despite the extensive trials of the tasks that are carried out. Teachers should be aware of the expected outcomes for the tasks despite not having access to the Marking Guidelines at this early stage.

The general standard in this task was quite high. However, accuracy marks were often awarded incorrectly. The observations required were extensively explained in the Marking Guidelines but it was apparent that these were often ignored or overlooked. It was of some concern that for a few schools and colleges the teacher results themselves were incomplete or poorly expressed. This sometimes resulted in the award of a lower accuracy mark on moderation. Happily, the use of 'clear' to mean 'colourless' appears to be diminishing.

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## CHM3T/Q14: Written Test

This paper appeared to be slightly less popular than CHM3T/P14. Again, students usually coped with the early questions in Section A confidently but struggled at times with the detail needed in the later questions. Answers in Section B were often disappointing.

### Section A

Question 1 proved more troublesome than expected, perhaps because of poor expression of ideas rather than a lack of understanding. It was also a little confusing for some markers who did not realise that both parts of (a) needed a correct answer for the award of the mark.

Questions 2 and 3 required students to look at their own results and make some deductions. In quite a few cases the answers, though acceptable on the basis of the Marking Guidelines, did not fit with the observations they had recorded and so should not have been credited. For example, in Question 2, if the student had seen a white precipitate when both Y and Z reacted with NaOH then the only correct response would have been to say that it was not possible to make the determination. This underlines the need for schools and colleges to trial the task to ensure correct and consistent observations.

In Question 4(a), it was disappointing to note that there were many instances of missing or incorrect state symbols that were missed or ignored by the marker. The logic required in Question 4(b) again required a careful and sequenced expression of ideas that some found challenging.

The information and test in Questions 5 and 6 were well known and usually well expressed with occasional confusion regarding the concentration of the ammonia solution used.

### Section B

The calculations in parts (a) to (d) of Question 7 were generally well done although there was some confusion regarding the number of significant figures (both in answers and the marking) and with some lower-scoring students experiencing difficulties in part (d). However, the ideas underlying part (e) gave a greater challenge and many partial answers were seen (and sometimes incorrectly credited).

Questions 8 and 9 were well answered in the main with the usual caveat about state symbols. The formula of propanone was generally well known either as the molecular or structural formula.

The ideas in Question 10 were found to be quite challenging to all but the highest-scoring students and a great deal of confusion was seen regarding colours, solutions and precipitates. In the marking, it is important to appreciate that to gain partial marks the procedure described must be chemically correct; M3 could not be awarded unless there is some correct work up to this point. Answers were often jumbled and contradictory. Many students failed to add sodium chromate solution at the start and so could not gain any marks. Where this addition was done, some students mentioned the formation of a precipitate with the calcium ion solution that then dissolved on addition of water. Many students did not appreciate that the substances were already in solution at the start of the procedure.

As usual, the empirical formula in Question 11 was well done with a few arithmetic errors only.

### **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](#)