GCE

Chemistry

CHM3T – Investigative and Practical Skills in AS Chemistry
Report on the Examination

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General Comments

The moderation scheme ran smoothly and successfully once again and the very great majority of schools and colleges completed the administration of assessment correctly. Whilst most marking by teachers was accurate and reliable, the standard of some marking was not of the required standard.

Administration

Moderators are very grateful that the majority of schools and colleges submitted a complete, well presented sample for moderation by the 15 May deadline. Moderators would once again ask that schools and colleges who failed to meet the deadline this year make every effort to comply with it next year.

A few schools and colleges failed to understand that if they have unit entries of twenty or below they do not require sampling but should instead send the work of all students directly to the moderator by 15 May. Most schools and colleges with more than one student group clearly indicated which teacher result applied to each individual student.

Schools and colleges are reminded that 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. A number of schools and colleges unnecessarily continued to have their students complete both.

There seemed to be a definite increase in the number or errors in Centre Mark Forms. Some moderators sent a steady stream of Mod/Cen/Adm forms to schools and colleges advising them of addition errors and transcription errors. Schools and colleges are strongly advised to ensure the students' marks are correctly entered as not all errors can be rectified by the moderator's marking of the sample.

Preparation

Schools and colleges are reminded that only the highlighted information contained within the Teachers' Notes (under 'Information to be given to candidates**'**) can be given to students and this should be done no more than a week before students attempt the Task. Schools and colleges must not provide their students with any further information or resources.

AQA also 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.

PSA

The PSA exercises remain popular with schools and colleges and covering the full range gives students a good basic grounding in practical techniques. In virtually every school or college, this section does not discriminate between students. Scores of 11 or 12 for this section are almost universal, even for students at the E grade boundary.

Marking

The majority of schools and colleges were able to apply the published Marking Guidelines successfully and accurately, at least as far as the more routine questions were concerned. The standard of marking sometimes dropped alarmingly in *How Science Works* questions, especially when a similar question had not appeared before in an ISA. In some cases, answers which were vague, contradictory or plain wrong were given credit. This undue generosity continues to be the main reason for a mark adjustment.

I trust regular readers will excuse the repeated following advice. Accurate marking requires that:

(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 'precipitate', 'the mixture turns white' or 'the solution turns cloudy'.

Similarly, if 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. One or the other only is insufficient and must not gain the mark.

These types of mistake **cannot** be given the benefit of doubt.

(b) 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. Answers which contain a contradiction, such as 'sodium sulfate, $NaSO_4$' are not worth a mark. Teachers can ignore additional material if it is a true statement, but irrelevant to the question. However, chemical errors must be penalised **every** time.

Some schools and colleges had difficulty with marking when answers differed from the published scheme. Marking was often inconsistent; correct chemistry that did not precisely follow the Marking Guidelines was penalised while answers of very little merit were credited. The marking can be massively out of tolerance, with double figure discrepancies sometimes seen.

The Marking Guidelines cannot cover all possible answers and it is inevitable that teachers will be faced with a range of additional responses. Each school or college has an Assessment Adviser allocated to them, part of whose role is to give help in applying the Marking Guidelines.

Some schools and colleges take a real pride in providing a clear indication of the marks awarded, with supporting annotation where needed. Some confusion is inevitable when the marker does not always use ticks and underlining consistently or indicate the marks for each question or part question in the margin. This inconsistency does lead to incorrect additions and transposition errors.

CHM3T/P13: Task

Students rarely have difficulty with a titration exercise in a task, and high marks were again common. The main problem for students was the school or college making a mistake with one of the reagent solutions resulting in a very low titre value. In such cases, it becomes almost impossible for students to score well in the accuracy section because the school or college **cannot** increase the tolerance boundaries for the accuracy marks. In a few cases, the task did not work at

all, and the school or college had to apply to AQA for permission to repeat the task. Teachers are once again reminded that **the task must be trialled before the students undertake it**, even if the exercise is routine.

Many students need reminding that a complete table will require columns for 'Initial volume' (even if zero), 'Final volume' and 'Titre'. It was surprising how many students thought that the initial reading of a burette was 50 cm^3. The teacher 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 for accuracy. If the error is overlooked by the marker, the discrepancy in the mark awarded for the task may 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 cm^3 of each other then no marks can be awarded for accuracy.

A few teachers were unduly lenient when awarding the mark for precision of recording. Students must record all non-zero volumes to 0.05 cm^3. A small number of teachers, having realised that the task value was unrealistic, arbitrarily and incorrectly gave the students a teacher value for use in the Written Test. Teachers are reminded that this use of a teacher value is meant for students with no task results at all. Schools and colleges are reminded that if something goes drastically wrong with a task, they must contact the Subject Team at AQA for guidance **before** the students attempt the Written Test.

CHM3T/P13: Written Test

This paper proved demanding and a wide range of marks was seen. Students usually completed the calculation questions in Section A confidently and well but were less impressive in Section B. 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 be given the mark if they have included a non-concordant titre in the average. Two titres are concordant if they are within 0.10 cm^3 of each other. When a set of readings such as 22.45, 22.55 and 22.65 are obtained, the student is expected to select the first two or the last two for the average. The answer 22.55 cannot be given the mark.

In Questions 2 and 3, some teachers did not penalise students who gave answers to fewer than the 2 significant figures stated in the Marking Guidelines. In the volumetric calculation in Question 4, some students used the average titre as the scaling factor, rather than 25. This is a serious error and the student can only access the precision mark. Many students failed to record the final answer to 3 significant figures but were still awarded the last mark. This marking error was widespread and some moderators wondered if the concept of significant figures was misunderstood.

In Question 5(a), the method described in the Marking Guidelines assumed a conversion of the given mass in 5 dm^3 to the appropriate mass in 1 dm^3. Some students produced correct methods based on 5 dm^3 by scaling up the answer from Question 4. It was surprising to see how often this perfectly acceptable alternative method was marked as incorrect and awarded no marks. In

Questions 5(b)(i) and 5(b)(ii), many answers were not given to 1 decimal place, even though it was asked for in the questions. Some teachers apparently ignored the need for appropriate precision when awarding marks for these questions.

Most students were able to answer Question 6(a) correctly but then had trouble explaining what they meant in Question 6(b). Many gave up on the English Language and provided a detailed description of the whole calculation. Frequently, they still ended in confusion and lost the mark. In Question 7, a significant number of students did not appreciate the importance of the word 'essential'. They gave two or more precautions so often lost the mark.

Section B

In Question 8(a), most students completed the graph successfully. The usual problem was a mark being wrongly awarded for plotted points which did not cover half the paper. 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 Question 8(b). In graph 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.

Many students gave an answer to Question 8(c) which did not match their own graph. Similarly, students whose line of best fit was poor were occasionally not given a consequential mark for interpreting their own graph correctly. Answers to Question 8(d) were often poor and a good deal of vague and incorrect material was given credit.

The need to burn fossil fuels to generate energy was not well appreciated in Question 9(a). The equations in Questions 9(b) and 9(c) proved surprisingly elusive. Most students gave good answers to Question 9(d)(ii), but had little concept of what constitutes a raw material. Most simply mentioned that ammonia was made in Reactor 3, and were usually, but wrongly, awarded a mark for this incomplete answer.

CHM3T/Q13: Task

The task involved a rate of reaction experiment for the first time. By and large, schools and colleges coped very well. There were very few reports of failed experiments or unusable results. The task produced a wider spread of marks than a titration. The main error in recording was not giving the times taken to the nearest second.

Accuracy marks were often awarded incorrectly. Some teachers did not always check and correct the 1000/t values calculated by the student, the plotting of the data and the line of best fit when awarding marks for accuracy. This often resulted in the award of a lower accuracy mark than was deserved.

CHM3T/Q13: Written Test

This paper also proved demanding and a wide range of marks was seen. 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

In Question 1, students struggled to complete simple calculations correctly. A large number could not round numbers correctly. Furthermore, errors were often seen in the marking of this question. Some students, and teachers, equated 3 significant figures with 2 decimal places. Answers to 4 significant figures were rarely punished, while sometimes answers with the correct precision were penalised.

The main problem in the graph in Question 2 was the choice of a strange scale. The student then found it difficult to plot the points accurately, and read values accurately in Question 4. In Question 3, doubled or kinked lines of best fit were often given full credit for which they did not qualify.

Many students could not define rate of reaction correctly in Question 5. Some teachers wrongly awarded a mark for incomplete answers. A majority of students suggested that the use of 1000/t for the rate was mainly to make plotting easier. A surprising number were allowed a mark for this irrelevant answer.

Question 6 posed problems for students and teachers. A number of students did not use the data from Question 4, choosing another pair of concentrations instead. This was often incorrectly allowed by the teacher. Many answers were not marked consequentially on the student's actual data. Some students felt that the data only supported the collision theory when there was an exact doubling of the rate, making no allowance for experimental error. Many students spoiled a good answer by talking of an increase in rate, rather than a doubling. This question was also marked very generously at times as the second mark was often allowed for answers which did not contain the key phrases underlined in the Marking Guidelines. Doubling of the number of successful collisions was not enough on its own. To earn the second mark, students had to appreciate that this doubling occurred in a given time period.

In Question 7, a number of teachers did not appreciate that the two marks were awarded independently, only allowing the choice of experiment if the reason was correct. The idea of an error in volume measurement eluded most students when the evidence did not support the collision theory. Teachers are reminded that in this type of question, a reference to greater errors, without a specific reference to where the error occurs, is never worth a mark.

Most students were able to score at least one mark in Question 9, although a number talked about sulfur rather than sulfur dioxide.

Section B

Question 10 was found demanding. Few students were able to relate correctly an increase in concentration to an increase in temperature. Many answers contained no reference to temperature at all. In addition, some teachers tended to mark this question generously. As in Question 6, many students should have not been awarded the second mark as they did not state that there would be more successful collisions in a given time. Some students were incorrectly given full credit without making any reference to the extra heat generated by the reaction affecting the rate of this reaction.

In Question 11, a surprising number of students did not realise that the surface coating was magnesium oxide, and an even larger number thought that magnesium oxide would not react with hydrochloric acid. This chemical error often went unpunished. Question 12 was answered well, although many students gave only one difference, spreading the explanation across all four answer lines.

In Question 13, a large number of students referred to solubility of the metals themselves rather than the sulfates. A solubility comparison was often lacking and few students appreciated that the insoluble calcium sulfate would prevent further contact between the acid and the metal.

Given the increasing pressure on schools and colleges to deliver the teaching programme, this was, overall, a very positive session. Teachers are once again thanked for the trouble taken with the coursework. Their efforts continue to be much appreciated by the moderator team.

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 http://www.aqa.org.uk/exams-administration/about-results/uniform-mark-scale/convert-marks-to-ums