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Chemistry CHM3T

(Specification 2420)

Unit 3T: Investigative and Practical Skills in AS Chemistry

Report on the Examination

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General Comments

Once again schools and colleges have largely maintained their excellent and much appreciated efforts. The moderation scheme ran smoothly and successfully. The very great majority of schools and colleges completed the administration of assessment correctly. However, the standard of marking showed some deterioration compared to last year.

Administration

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

The great majority of schools and colleges completed the paperwork satisfactorily, although some moderators felt that there had been an increase in the number of samples which were missing some of the paperwork. A number of 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 May 15. There was a marked decrease in the number of schools and colleges failing to include target values for the tasks and a surprising number of centres forgot to include a Centre Declaration Sheet. Most centres with more than one student group clearly indicated which target value applied to each individual student. The more enterprising schools and colleges wrote the teacher value on the Task Sheets of students in the sample to ensure that there was no possible confusion.

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 centres unnecessarily continued to have their students complete both.

The moderator team was again pleased that the great majority of schools and colleges completed the paperwork in full, and there were very many instances where the moderator gratefully benefited from a lot of thoughtful work by the schools and colleges.

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 candidates 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*. Any failure to do so would be investigated by AQA.

As with any specification, AQA's Irregularities and Malpractice team investigate thoroughly any cases where regulations, such as those mentioned above, are not being followed.

PSA

The PSA exercises have proved 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. Some concern was expressed by moderators that the standard of marking sometimes dropped alarmingly in *How Science Works* questions, especially when a similar question had not appeared before in an ISA. Answers which were vague, contradictory or plain wrong were given credit. This undue generosity was almost always the reason for a mark adjustment.

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, part of whose role is to give help in applying the Marking Guidelines. It is fair to say that schools and colleges whose marking causes concern do not tend to consult an adviser.

Accurate marking requires that:

(a) the student is not given the benefit of the doubt whenever an answer is on the right lines, but does not really match the required response. There must be a balance in what is credited and what is not.

(b) when the answer in the Marking Guidelines includes specific chemical terms or phrases, 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'. This type of mistake **cannot** be given the benefit of doubt.

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

The standard of marking was, however, generally high. 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/P12: 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.

There were instances of schools and colleges asking their Assessment Adviser if another indicator, invariably phenolphthalein, could be substituted for the nominated indicator. There must be a compelling reason for such a major change and it has to be sanctioned by the AQA Subject Team. Major changes to an ISA are outside the remit of an Assessment Adviser.

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 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.

Some schools and colleges 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 schools and colleges, 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.

One school allowed their students to work in pairs. This is a breach of AQA rules and such cases are passed to the AQA Irregularities and Malpractice team.

CHM3T/P12: Written Test

This paper proved demanding and a wide range of marks was seen. 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. 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 the volumetric calculation in Question 3, many markers misread the Marking Guidelines and failed to penalise sufficiently a student who used a wrong molar ratio. This was a serious chemical error and the student should not have been given any marks for the question. A good number of students were incorrectly allowed the second mark for answers such as 0.05. This type of answer, being to one significant figure only, was disallowed in the Marking Guidelines.

In Question 4, very few centres overlooked the requirement to give the M_r value to one decimal place.

Answers to Question 7(a) were surprisingly poor. Answers related to mixing of reagents or removal of chemicals left over from previous experiments were often wrongly allowed.

In Question 7(b), many students claimed that the addition of water would not change the concentrations of the reagents. Very surprisingly this was often allowed by the teacher. In some cases nearly every student in a school or college gave an answer referring to the neutrality of water which was duly, and incorrectly, given a mark by the teacher.

Students tackled Question 8 with confidence and high marks were common. The usual omission was a reference to the physical process needed to obtain a solution. Occasionally students were given credit for the appearance of a key word in a ridiculous context, such as awarding a mark for filtering molten ash.

The answers to Question 9(a) were pleasing because few students would have been familiar with the use of an anhydrous salt to dry an organic liquid. Marks were usually lost through confusing the organic liquid and water. A complete answer to Question 9(b) was beyond most students. The idea that the answer was based on collision theory was well understood, but the majority of students failed to refer to collisions between water and potassium carbonate. Many schools and colleges awarded the mark for this question despite very vague or incomplete answers.

Section B

The great majority of students scored at least one mark for the empirical formula in Question 10. Occasionally a mark was awarded for working when the method chosen made little sense. Dividing the M_r by the percentage by mass was not worth the mark for working, even if by chance it arrived at the correct answer.

The marking of the three parts of Question 11 was often very generous indeed. In Question 11(a), many students failed to appreciate that it is the loss of the water causing the dampness during the reaction that causes the error yet a mark was often awarded for answers which missed this crucial point.

In Question 11(b), most students realised that the lid was there to stop something from escaping from the crucible. A large number of students stated that the lid would keep everything inside, including heat. A mark should not have been awarded for this answer which, if true, would invalidate the experiment.

In Question 11(c), the majority of students made no mention of mass, weighing or the use of a balance, contenting themselves with a vague statement such as ‘errors would be too large.’ This type of general answer is never worth a mark. The nature and source of the error has to be clearly stated.

Some teachers were very harsh when marking the calculation in Question 12(a). It was quite common to see students receiving few, if any, marks for a correct answer achieved by a slightly unusual route. Schools and colleges are reminded that there is usually more than one way to complete a calculation and the Marking Guidelines cannot cover all possible mathematical pathways. If the method chosen by the student is chemically sound it must be credited in full. The great majority of students realised that an incomplete decomposition was the likely reason for a greater mass than expected in Question 12(b).

The equation in Question 13(a) was well done, while the better students appreciated that the production of a large volume of gas would propel a rocket in Question 13(b). In Question

13(c), the majority of students believed that an oxidising agent is a very flammable substance, and were incorrectly awarded a mark for keeping it away from flames. Some schools and colleges even awarded a mark for trite answers such as 'keep it away from people' or 'do not use it'.

Question 13(d) was a testing *How Science Works* question, and this was another area where schools and colleges were too generous in awarding the marks. The appearance of the word 'precipitate' in an answer to the first part usually triggered the award of the mark, even if it was accompanied by erroneous information such as 'fizzing'. Similarly, answers such as 'solution becomes slightly cloudy' or 'cloudy substance, rest dissolves' were incorrectly awarded this mark.

CHM3T/Q12: Task

Some schools and colleges had difficulty in obtaining the expected observations in some of the tests. As with CHM3T/P12, some schools and colleges assumed that all would be well on the day and failed to trial the task beforehand. Sometimes students obtained unexpected results even after a successful trial. The Marking Guidelines allowed for reasonable variations.

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 have to be aware of the changes when marking scripts. A significant number of schools and colleges were very generous when marking the observations, accepting loose descriptions instead of the correct chemical terms.

Many students appear to need encouragement to use the correct terminology rather than simply 'putting what you see'. While virtually all students are familiar with the term 'precipitate' a significant number of students, and a small minority of teachers, only tend to use this term when they can see large solid particles at the bottom of the test tube. Answers such as 'the solution turned cloudy' were depressingly common, and were often given credit. At the risk of labouring the point, in chemical terms a solution cannot be cloudy or white. If a mixture is not clear, then a precipitate is present. Similarly, 'clear' cannot be accepted as an alternative to 'colourless'.

Students often regard the use of the word 'solution' as an optional extra, and run the risk of losing a lot of marks. Some schools and colleges allowed full marks to students who omitted the word solution every time in the Test 3 reactions, even when the word solution was underlined in the Marking Guidelines. Schools and colleges are reminded that 'goes clear' is not an acceptable alternative to 'the precipitate dissolves'.

In Test 3, the reaction with some concentrations of the magnesium salt did not produce a precipitate. The student should then have recorded 'no visible change' when sodium ethanedioate was added, and 'no visible change' when hydrochloric acid was added. Many students simply wrote 'no visible change' once only and were incorrectly awarded both scoring points. As a general rule, two scoring points cannot be awarded for a single observation.

CHM3T/Q12: Written Test

This paper proved accessible to students and many high marks were seen. The main problem areas are given below.

Section A

In Questions 1 and 2, most students identified the metal ions correctly. Schools and colleges are reminded to check the student's actual results when the identification seems to be wrong and award consequential marks where appropriate. Only the best students could write a correct equation in Question 3.

In Question 4, most students identified the precipitate correctly as barium chromate. A few lost the mark by adding an incorrect formula or oxidation state. Similarly, most students were able to predict the behaviour of a strontium salt in Question 5.

Few students were able to use the given results to identify the anions in Questions 6(a) and 6(b). In Question 6(c)(i), some students lost the mark because they could not distinguish between bromine and the bromide ion. Students should be reminded that 'bromine ion' is not an acceptable answer. In Question 6(c)(ii), while most students are familiar with the test for halide ions, asking a question about the behaviour of the precipitates confused a few students.

Question 6(d) proved surprisingly demanding, with few students scoring the mark. Success seemed to be school or college specific. In many schools and colleges, none of the students in the sample gained this mark. In others, virtually all were successful.

Section B

In Question 7, most students completed the graph successfully. The usual problem was a mark being wrongly awarded for plotted points which did not cover half the grid because the student started the *y*-axis at zero. Some schools and colleges were very generous when awarding the mark for drawing a line of best fit. 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. A few schools and colleges did not allow the mark for extrapolation when the line of best fit was poor. As long as the line is extended correctly the mark for extrapolation can be awarded. If the line becomes kinked when extrapolated the mark for extrapolation cannot be awarded.

A few teachers failed to realise that the marks for Questions 8 and 9 were essentially for drawing the graph correctly rather than for reading from a poorly drawn graph. Few students lost the mark in Question 10 for incorrect precision.

Question 11 proved straightforward but a fair number of students used an incorrect mass in the equation. In Question 12, a good number of students were incorrectly allowed the second mark for the answer 0.01. This answer, being to one significant figure only, was disallowed in the Marking Guidelines.

Question 13 was well answered, although a surprising number of students omitted the negative sign in their final answer.

Answers to Question 14 were generally good; the common error was to suggest that stirring ensured that the mixture was homogeneous. In Question 15(b) a number of students thought that heat was the danger to the equipment and lost the mark.

The above notes are intended for that minority of schools and colleges experiencing difficulty in meeting the criteria. They must not be allowed to unduly detract from the very healthy overall picture. Given the pressures on teachers to deliver the teaching programme, this was

once again a very positive and encouraging session. Schools and colleges are again warmly commended for the trouble taken to assemble a sample which proved to be easy to moderate. 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 About Results pages of the AQA Website.

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