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Chemistry CHM6T

(Specification 2420)

Unit 6T: Investigative and Practical Skills in A2 Chemistry

Report on the Examination

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General Comments

The internal assessment of practical skills at A2 also ran smoothly and successfully. The very great majority of schools and colleges have come to terms with this format for assessment, and the standard of marking of the A2 work was generally good.

Many of the points made in the report for CHM3T apply to this module too. They are repeated here for the benefit of centres with A2 students only.

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. Students scored even better in this section than at AS. Scores of 12 were almost universal.

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.

CHM6T/P12: 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.

While virtually all students are familiar with the term 'precipitate' a significant number of students failed to appreciate that a precipitate is produced by a reaction in solution. It is incorrect to use the term for an excess of a solid reagent. In Test 2, a large number of schools and colleges awarded the scoring points to answers mentioning a green precipitate, even though this response was disallowed in the Additional Guidance.

The appropriate use of the word 'solution' continues to elude many students, and some teachers. The uncertainty is compounded by chemists being less than rigorous in everyday use of this term. It is common practice for the word 'solution' to be omitted when describing the colour change of an indicator in Test 1. Although this is unhelpfully inconsistent, indicator reactions rarely involve any change of state so the omission does not cause ambiguity. In three of the reactions in Test 2, a green solid reacted to form a blue solution. The word 'solution' must be included; 'turns blue' could apply to the solid. As a concession to the students, the Additional Guidance instructed schools and colleges to penalise the omission of the word 'solution' once only. Many ignored this instruction in the Test 2 reactions and allowed full marks to students who omitted the word solution every time, or penalised students each time the word solution was omitted.

Two scoring points **cannot** be awarded to a student making one observation, even when the teacher obtained the same result.

Many students appear to need encouragement to use the correct terminology rather than simply 'putting what you see'.

CHM6T/P12: Written Test

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

Section A

Most students were able to distinguish between the two acids in Questions 1 and 2. However, in Question 2 some centres did not mark consequentially on the student's answer to Question 1.

In Question 3, most students were unable to predict a correct pH range. Many students were awarded a mark in the second part of this question for answers which were incomplete or very vague. The need to refer to the weak acid/base or both acids/bases was often missed.

In Question 4, those students who were familiar with the test for halide ions had little difficulty in correctly answering a question about the behaviour of the precipitate.

Question 5(a) caused similar difficulties to Question 3. Many students were unable to select a correct mixture, but were awarded a mark for an explanation which was incomplete or very vague. Students needed to mention the presence of both acid and salt in the mixture to merit the mark.

In Question 5(b), many students confused a half equivalence mixture with a pH graph. An explicit statement that $[HA] = [A^-]$ was often omitted, and quite frequently was not penalised. It

was surprising how many students used a pH value without taking the trouble to measure this value.

Section B

Many incomplete answers were given credit in Question 6(a). When the components of a two-part answer are linked by the underlined word 'and' **both** components are needed to earn the mark.

A pleasing majority of students were able to complete the calculation in Question 6(b). Occasionally, a centre was unduly harsh in penalising minor rounding in the intermediate steps.

Question 7 discriminated well between students that could express scientific ideas logically, concisely and accurately and students who could not. The question would have discriminated well if some schools and colleges had been less keen on awarding a mark for incomplete answers or answers which were disallowed in the Additional Guidance. A vague reference to removing impurities was often credited twice. Schools and colleges are reminded that when the answer in the Marking Guidelines includes words which have been underlined, **all** of these words, or their very close equivalents, **must** be present if an answer is to be credited.

Students continue to struggle with calculations of a yield in a chemical reaction. Only the better students completed Question 8(a) successfully. In Question 8(b), most students were able to suggest one reason for the yield not being quantitative.

The equation in Question 9(a) proved demanding, with a surprising number of students representing hydrogen as 2H. The diagram in Question 9(b) was well drawn by the majority of students.

CHM6T/Q12: Task

A2 students usually have even less difficulty than AS students with a titration exercise in a task and this again proved to be the case. High marks were common.

The Additional Guidance for a titration task is very detailed and covers most eventualities. A minority of schools and colleges do not appear to have applied this guidance consistently and the mark given to the occasional student was very generous. Students must be told 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, even at A2.

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 candidate 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.

Teachers are once again reminded that **the task must be trialled before the students undertake it**, even if the exercise is routine. The Assessment Adviser can be consulted if

problems arise. If something goes drastically wrong when the students complete the task, the school or college must contact the Subject Team at AQA for guidance.

CHM6T/Q12: Written Paper

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

Section A

In Question 1, most students could calculate the average titre correctly, but teachers are reminded to check the student's calculation. A fair number of students included a non-concordant result in the calculation but were still awarded the mark.

The equation in Question 2 is one of the most familiar of redox equations and proved straightforward for the vast majority of students.

In Question 3, most students could calculate the number of moles of manganate(VII) but a number could not apply the correct mole ratio for the second mark. A small number of students gave the final answer to one significant figure but were still awarded full marks. Question 4 was also well answered.

Questions 5(a) and 5(b) were testing *How Science Works* questions and only the best students scored both marks. A number of students were allowed marks for answers which were either vague, included contradictions or were basically incorrect.

The diagram in Question 6(a) was poorly drawn by the majority of students. Schools and colleges tended to compensate for errors by generous marking which often ignored the Marking Guidelines. Diagrams that included a Y-shaped funnel or omitted the filter paper or which would not be gas-tight or simply would not work were routinely awarded marks by some teachers.

The calculation in Question 6(b) was completed successfully by most students, with clear and logical working. Many students forgot to convert 11.85 to three significant figures at the end of the calculation so should have lost the final mark. Question 6(c) was well answered.

Question 7 posed few problems, though a number of students confused the graduated flask with a burette.

Students usually struggle with questions where data from a table of E^o values is used to explain a chemical reaction, and Question 8 was no exception. Very few answers worth both marks were seen. Many students could not express themselves clearly while many others confused chlorine and the chloride ion. Statements such as 'manganate(VII) ions have a more positive electrode potential than chloride ions' and 'chlorine will oxidise manganese(II) ions' were very common and were often wrongly credited with a mark. In this question, students frequently ruined a promising answer by including some incorrect chemistry. Examples included 'manganate(VII) ions have a more positive electrode potential so will reduce chloride ions to chlorine' and 'hydrochloric acid was reduced by manganate(VII) ions'. It was difficult to see how an answer such as 'HCl is not electronegative enough to acidify $KMnO_4$' could have been given any marks but it was.

The calculation in Question 9 discriminated well. There were a lot of complete answers but many students, as expected, forgot that sulfuric acid is a dibasic acid.

The equation in Question 10(a) must have been unfamiliar to most students but it proved

straightforward. In Question 10(b), most students appreciated that the presence of a brown precipitate would obscure the end-point, but the effect on the titre was not widely understood. Many students made a vague statement that the titre would be changed, but didn't explain the change itself.

Most students appreciated the effect of a large volume of water in Question 11, but many added that manganate(VII) was a weak oxidising agent in solution so lost the mark because of the chemical contradiction.

Section B

The graph in Question 12(a) posed few problems for A2 candidates. Occasionally a student used a poor scale so that the plotted points did not cover at least half of the grid, and lost a mark. A few candidates did not include the origin in their graph. In such cases the marker can still allow the first mark if, in the opinion of the marker, the line as drawn would pass close to the origin if it had been included.

Only the best students scored both marks in the calculation in Question 12(b). A significant majority forgot to double the concentration of the iron(III) sulfate obtained from the graph to give a concentration of iron(III) ions in solution. This conversion seemed to perplex a number of teachers as it was quite common to see both marks being awarded for concentration of the iron(III) sulfate.

The calculation in Question 12(b) proved equally demanding. Many students were once again stumped by the calculation of a dilution.

The benefits of well-water were generally appreciated but too many schools and colleges allowed a mark for a general statement which did not tie a specific metal ion to an appropriate benefit.

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.

UMS conversion calculator www.aqa.org.uk/umsconversion