NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Qualifications Framework Levels 1–3, 2005

Chemistry

National Moderator's Report

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General Guidance for Assessors of Achievement and Unit Standards

The purpose of external moderation is to provide reassurance that assessor judgements are at the national standard and are made on the basis of assessment materials that are fair and valid.

All assessment materials are expected to:

- give the learner the opportunity to meet the requirements of the standard
- have an assessment schedule that gives evidence of appropriate learner responses and clear judgements at all levels.

The Ministry of Education contracted subject experts to write assessment resources for achievement standards. These are not pre-moderated. The intention is that they are modified to suit teaching programmes and learner needs. They do not provide 'rules' but suggest different ways of assessing to the nationally registered standard.

General Overall Comment

The moderation of internally assessed achievement standards and unit standards in Chemistry has proved to be effective in establishing national consistency of assessment materials and assessor judgements.

The level 1 and level 2 achievement standards were revised for 2005 and it was expected assessors would use the new versions. However, this was not always the case and, at times, it was not clear which version of the standard the assessor was using. The activity must clearly state both the number and version of the standard.

Level 3 standards were generally well assessed, as this was the second year of using these for many providers. Changes have been made to these achievement standards for 2006.

Most schools assessing against level 2 and level 3 achievement standards have used the exemplars from the TKI website or these exemplars with changes made to the examples used.

AS 90169 Version 3: *Carry out a practical chemistry investigation with direction*

There is only one criterion for Version 3 of this standard and this has allowed a more holistic judgement than earlier versions. However, the points stated in Explanatory Notes 5, 6 and 7 must still be considered.

Version 7 of the *Generic Template* available on the TKI website clearly outlines the requirements of an activity to meet the requirements of the standard. A different format may be used but the *Generic Template* indicates the level of direction that should be given.

For Achievement, the conclusion may be an interpretation based on the processed data, while for Merit and Excellence the conclusion must be valid and relate to the purpose. This means that for Achievement, an investigation in which the purpose is to investigate reaction rate as a variable is altered, may have a conclusion which describes time taken with respect to the variable whereas reaction must be referred to for Merit and Excellence. Excellence is based on the level of the evaluation of the investigation.

To carry out a practical chemistry investigation, a minimum of three values of the independent variable are required. If the data produced is to be graphed, it is preferable that five values are used for the graph to be meaningful.

If learners are planning, collecting data, interpreting and/or reporting as part of a group it is likely that the investigation is not fair and valid. The assessor must be able to confirm that each learner has met the requirements of the standard and the grade awarded reflects the ability of the student to carry out a practical chemistry investigation with direction. Evidence of this is required for the purposes of moderation.

AS 90170 Version 3: *Process information to describe a use of chemistry knowledge with direction*

There is only one criterion for this standard and the emphasis is on processing information. There is no requirement to link to technology, as in the previous versions.

The levels of achievement are based on *"describe", "explain"* or *"discuss"* and these terms are defined in Explanatory Note 6. For all levels of achievement the report must be mostly in the learner's own words and references or sources of information must be stated.

Learners must not be given too much direction. The standard does not require the learner to find the information by research, although this is possible. At least two different sources of information must be used and these may be supplied by the assessor.

AS 90305 Version 2: *Carry out qualitative analysis*

This version of the standard is based on one criterion so that the theory and practical aspects involved are integrated.

Achievement requires learners to carry out the practical work and identify precipitates formed as the unknown ions in the solutions are determined. A majority of ions must be correctly identified. This includes identification of all precipitates that are formed during the analysis.

Merit requires learners to also write balanced equations for these precipitation reactions occurring. It is expected a majority of the precipitation equations will be correctly written to meet sufficiency. If two precipitations occur for one ion, then both must be correct if that ion is to be judged correct at this level of achievement.

To achieve Excellence, in addition to the requirements for Merit, learners must be able to identify and write balanced equations for complex ions that are formed in the analysis. As for Merit, a majority of the complex ion formation equations must be correct and where there is more than one such equation for an ion, both must be correct to make a judgement of Excellence for the ion.

Sufficiency is dependent on the actual ions used but a guideline is that this needs to be a majority of the opportunities provided.

The unknown ions in solution need to be carefully selected to ensure ample opportunity for the learner to provide evidence as required.

Some ions, eg Zn^{2+}, as an unknown require tests and observations plus four different equations – precipitation of $Zn(OH)_2$ with both sodium hydroxide and ammonia solutions, complex ion formation of $[Zn(OH)_4]^{2-}$, $[Zn(NH_3)_4]^{2+}$) if the judgement is at the level of Excellence.

The degree of difficulty, as well as the total number, of ions needs to be considered when designing the assessment activity, eg more than one coloured species in a limited number makes an easier task and more correct ions would be expected. If only two substances are used, both cation and anions are to be determined. All would be expected to be correct for Excellence and this would mean all four ions should form precipitates and at least two form complex ions.

Too many unknown ions from Na^+, NH_4^+, NO_3^- or CO_3^{2-} in an activity limits the opportunity for the learner to demonstrate evidence of ability to write precipitation and complex ion formation equations.

Chlorides of non–amphoteric metal ions, eg $MgCl_2$, are difficult to determine since the addition of ammonia solution to prove the presence of the chloride ion will precipitate the metal hydroxide.

A flow chart procedure is provided with the activity available on the TKI website but it is not essential that this is the procedure provided.

The assessment schedule supplied with the activity for moderation purposes must specify the actual ions used. If it is an either/or situation the actual ion must be supplied in the evidence of the assessment schedule, not evidence for both.

AS 90306 Version 2: *Carry out an acid-base volumetric analysis*

The first criterion requires a titration to be carried out and the judgement is based on the accuracy of the data recorded.

The second criterion requires a distinction to be made between Achievement, Merit and Excellence, based on the learner's ability to solve problems related to volumetric analysis. This requires the assessor to provide a standard solution for which the concentration is given to three significant figures.

Data gained from the analysis must be recorded in a way that can be easily interpreted. Initial and final burette readings are required, as well as the titre used. Without this it is not possible to check the correctness of the subtractions of volumes involved. It is not usual practice to refill the burette to the zero marking for each titration.

Learners reading a burette to only an accuracy of 0.1 mL may be disadvantaged when it comes to the accuracy of average titre. Reading a burette to a higher level of accuracy, eg to 0.05 mL or 0.02 mL, is expected.

The standard solution provided must be given to an accuracy of three significant figures if this is to be the required accuracy of the unknown solution. Also, to ensure understanding of the calculations involved, it is advisable to use a standard concentration of values other than ones such as 0.100 mol L^{-1}, eg the standard solution may be given a value such as 0.112 mol L^{-1}.

For the purposes of moderation the volume, as determined by the assessor, must be supplied with the material submitted.

A minor error is considered an arithmetic error rather than an error associated with the chemistry involved, eg the mole ratio applied incorrectly is a chemistry error, not a minor error.

AS 90763 Version 1: *Solve simple quantitative chemical problems*

The single criterion for this standard requires a distinction to be made between Achievement, Merit and Excellence based on the learner's ability to solve problems involving a varying number of steps.

It is expected that for Excellence learners are able to present their answers accurately and with appropriate units. To make a judgement on appropriate use of significant figures the questions given must be consistent with accuracy of data given. A learner achieving at Excellence would be expected to have all answers to questions recorded appropriately.

The judgement for each question, or part of question if appropriate, is made at one level only, eg if a learner meets the requirement of Excellence by successfully carrying out a complex problem, judgements of Achieved and Merit are not awarded as well.

Explanatory Notes 2, 3 and 4 clearly state the type of problems that are required to enable the learner to show evidence for each level of achievement.

AS 90694 Version 2: *Carry out an extended practical investigation involving quantitative analysis*

The first criterion requires a distinction to be made between Achievement, Merit and Excellence based on the plan developed and the ability to carry this out. This requires learners to determine any standard solutions that are required, and that they make, and standardise these solutions. For Excellence, the description of the method must show a clear understanding of the overall analytical technique.

The second criterion requires a distinction to be made between Achievement, Merit and Excellence based on the learner's ability to process data collected and present a report. For Merit and Excellence the quality of the report must be considered rather than just the quantity of data collected. The discussion must show some critical thinking rather than more trivial comments such as those related to the learner's lack of care or more experiments that should have been carried out.

The investigation involves collection of quantitative data at Level 8 of the curriculum, keeping a separate log book (Explanatory Note 5), processing data, and presenting a report that includes a conclusion and discussion/evaluation.

Logbooks are required for the purposes of moderation and these need to contain all aspects of planning and raw data collected.

The learner is expected to prepare and standardise solutions required for the analysis although the assessor may supply volumes of solutions, such as acids, that are not used as standards and indicators such as starch solution.

The learner needs to show understanding of the analysis carried out and the method described in the report must be the one that was used. Any modifications will be evident in the log book and reasons for the changes should be found in the discussion of the report. Often, changes to the original method are required for the data obtained to be meaningful. To ensure a fair test the method needs to state how key or significant variables are controlled, as well as how the sample to be analysed was prepared or treated.

Equations for reactions occurring and examples of calculations carried out need to be clearly shown in the report. A summary of collected and processed data and relevant graphs is also required in the report.

The conclusion needs to relate to the purpose of the investigation and must be based on the processed data gained. Too often, learners neglect data values that do not fit the expected pattern or trend.

Excellence requires a sensible, in–depth discussion or evaluation of the investigation. This includes an understanding of significant errors and relevant background material. Repeated data, using a new sample, is required to check the reliability of the method.

Version 2 of this standard should be used in 2006. This version is based on one criterion and requirements for the different levels of achievements should be clearer.

AS 90695 Version 2: *Determine the concentration of an oxidant or reductant by titration*

The first criterion requires a titration to be carried out and the judgement is based on the accuracy of the data recorded.

The second criterion requires a distinction to be made between Achievement, Merit and Excellence based on the learner's ability to solve problems related to volumetric analysis. This requires the assessor to provide a standard solution for which the concentration is given to three significant figures.

Data gained from the analysis must be recorded in a way that can be easily interpreted. Initial and final burette readings are required, as well as the titre used. Without this it is not possible to check the correctness of the subtractions of volumes involved. It is not usual practice to refill the burette to the zero marking for each titration.

Learners reading a burette to only an accuracy of 0.1 mL may be disadvantaged when it comes to the accuracy of average titre. Reading a burette to a higher level of accuracy, eg to 0.05 mL or 0.02 mL, is expected.

The standard solution provided must be given to an accuracy of three significant figures if this is to be the required accuracy of the unknown solution. Also, to ensure understanding of the calculations involved, it is advisable to use a standard concentration of values other than ones such as 0.100 mol L^{-1}, eg the standard solution may be given a value such as 0.112 mol L^{-1}.

For the purposes of moderation the volume, as determined by the assessor, must be supplied with the material submitted.

A minor error is considered an arithmetic error rather than an error associated with the chemistry involved, eg the mole ratio applied incorrectly is a chemistry error, not a minor error.

Version 2 of this standard should be used in 2006. Version 2 has changes to the accuracy of data achieved in the analysis as required for Achieved, Merit and Excellence. (See Explanatory Note 5).

Unit Standards

Where unit standards are being used it must be recognised that all performance criteria of an element need to be met in order to achieve an element. In addition, all elements must be gained to achieve the unit standard. Therefore, for the purposes of moderation, the activity and student work submitted must include all elements of the standard. Also, the assessment schedule must clearly show the expected evidence at Performance Criteria level as well as the judgement statements.