



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Qualifications Framework Levels 1–3, 2006

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 judgments 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 judgments 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 majority of assessors assessing against level two and level three achievement standards have developed activities using the samples from the TKI website. However, at times these samples have been used without change. This does not fairly assess the learner since knowing the *answers* limits the validity of the assessment activity.

As many standards require numerical data in the related activity, assessors must be careful to supply the data with sufficient accuracy to meet the accuracy that is expected.

90169: Carry out a practical chemistry investigation with direction

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.

The investigation is *with direction*. However, too much direction cannot be given. For example an investigation on effect of concentration change on reaction rate, learners must make decisions on concentrations to use given only one solution to start with.

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. 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 rate must be referred to for merit and excellence.

Excellence is based on the level of the evaluation of the investigation. Evaluation cannot be limited to such things as ‘lack of careful use of equipment or measurement’.

Additional notes

In order 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 if the graph is to be meaningful.

If learners are planning, collecting data, interpreting and/or reporting as part of a group the assessor must be able to confirm that each individual 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.

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

The levels of achievement are based on *describe*, *explain* or *discuss* and these terms are defined in EN6. 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.

Too much direction must not be given. 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.

90305: *Carry out qualitative analysis*

The standard requires identification of ions, with supporting evidence to be provided by the learner. A suitable activity needs to contain

- a range of ions of different degree of difficulty
- sufficient ions involving complex ion formation
- a limited number of ions that do not precipitate or complex.

Achievement requires *identification of precipitates formed*. This means that all precipitates related to the ion must be identified for the ion to contribute evidence towards achievement. Identification of the precipitate may be by name or formula.

Similarly, for merit, *balanced equations for reactions where precipitates are formed* means all such equations for the particular ion.

In addition, excellence requires *balanced equations for the formation of complex ions* and this means all such equations for the particular ion.

Sufficiency is dependent on the actual ions used but is based on a majority of correct ions, not correct equations.

This means the design of the activity needs to be carefully considered. For example, if an activity contains 8 ions and only 3 form complex ions, 7 ions would therefore need to be correct to ensure at least 2 complex ions (ie a majority) were included for the learner to achieve excellence. However, if 5 of the ions formed complexes, this would mean that 6 ions would need to be correct to ensure that at least 3 complex ions (ie a majority) were included for the learner to achieve excellence.

Additional notes

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.

Some ions, eg Zn^{2+} , as an unknown require tests and observations plus 4 different equations (precipitation of $\text{Zn}(\text{OH})_2$ with both sodium hydroxide and ammonia solutions, complex ion formation of $[\text{Zn}(\text{OH})_4]^{2-}$ and $[\text{Zn}(\text{NH}_3)_4]^{2+}$) to meet the requirements of excellence.

90306: *Carry out an acid–base volumetric analysis*

The evidence statements prepared must include

- the expected titre for the analysis
- the calculated concentration of the solution.

For achievement, *a minor error is allowed but the solution must be a sensible one*. A minor error is considered an arithmetic error rather than an error associated with the chemistry involved. For example, the mole ratio applied incorrectly is a chemistry error, not a minor error.

For excellence, *the final answer must have correct units and an appropriate number of significant figures*. This means the standard solution provided must be supplied with 3 significant figures if this is to be the required accuracy of the unknown solution. Also, in order 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} .

Where an additional written problem is provided, this must contain a wide enough range of titres to allow learners to make a selection of concordant titres meeting the requirements of all levels of achievement.

Additional notes

Data gained from the analysis must be recorded in a way that can easily be interpreted. Initial and final burette readings are required, as well as the titre used. 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.

90763: Solve simple quantitative chemical problems

The judgement made is based on the complexity of the problem solved with an increasing number of steps involved at the higher levels of achievement.

A suitable activity will include

- a range of types of problems
- problems with varying numbers of steps
- data which requires understanding of units and significant figures.

The judgement for each question is made at one level only. For example, if a learner meets the requirement of excellence by successfully carrying out a *complex problem*, judgements of A and M are not awarded as well.

For excellence, *answers to calculations must demonstrate correct units and appropriate use of significant figures*. In order to make this judgement, the data given in the questions must be consistent with accuracy of data required. A learner achieving at excellence would be expected to have all answers to questions recorded appropriately, not just the questions leading to excellence opportunity.

Additional notes

A fair assessment activity will be one that is previously unseen by the learner since problems can be easily 'remembered'. When using activities on the TKI website, changing masses, amounts or concentrations stated in the questions will make these suitable.

90694: Carry out an extended practical investigation involving quantitative analysis

Evidence and judgement statements must contain detail relating to the requirements of EN's 5, 6 and 7 of the standard. Key aspects of these include

- investigating a possible trend
- developing a procedure
- keeping a log book
- recording and processing data
- making a valid conclusion
- making critical evaluation.

The samples available on the TKI website illustrate how an assessment schedule can be formed from the Generic Template.

Additional notes

The procedure may be based on a method supplied by the assessor and is developed through trialing. All planning, detail of solution preparation and data collected are recorded in the log book. Repeated data (using a new sample) is required to check the reliability of the procedure.

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

The report needs to be concise. A summary of collected and processed data is required rather than detail of every titration carried out. The detail remains in the log book. Equations for reactions occurring and examples of calculations carried out need to be clearly shown 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 trend. Although the investigation is in relation to a possible trend, the conclusion may be that there is no trend.

90695: Determine the concentration of an oxidant or reductant by titration

The evidence statements prepared must include

- the expected titre for the analysis
- the calculated concentration of the solution
- the calculated composition of the solution.

For achievement, *a minor error is allowed but the solution must be a sensible one*. 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.

For excellence, *the final answer must have correct units and an appropriate number of significant figures*. This means the standard solution provided must be supplied with 3 significant figures if this is to be the required accuracy of the unknown solution. Also, in order 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 merit and excellence, *determination of the composition of the sample will involve one mathematical conversion between the concentration of the solution analysed and the composition of the sample*. A conversion from mol L^{-1} to g L^{-1} is often used to meet this requirement although other conversions are possible.

Where an additional written problem is provided, this must contain a wide enough range of titres to allow learners to make a selection of concordant titres meeting the requirements of all levels of achievement.

Additional notes

Data gained from the analysis must be recorded in a way that can easily be interpreted. Initial and final burette readings are required, as well as the titre used. 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.

Unit Standards

Where unit standards are being used it must be recognised that all elements must be gained to achieve the unit standard with evidence of performance criteria within each element being met.

The assessment schedule must clearly show the expected evidence and judge