

Main changes resulting from the review

- All NZC Level 8 (NZQF Level 3) outcomes derived from the NZC are now assessed using achievement standards, and there are no longer any unit standards linked to the NZC.
- Existing achievement standards were reviewed and new achievement standards were developed to align with the NZC. See [table](#) below.
- Grading criteria for achievement standards were reviewed in accordance with the Standards Review Guidelines.
- Unit standards that recognised similar outcomes as achievement standards were recommended for expiry. See [table](#) below.

For a detailed description of the review of, and the changes to, the Chemistry standards see the Appendix at the end of this report.

Impact on existing organisations with consent to assess

Current consent for			Consent extended to		
Nature of consent	Classification or ID	Level	Nature of consent	Classification or ID	Level
Standard	6341	3	Standard	91387	3
Standard	6344	3	Standard	91391	3

Impact on Consent and Moderation Requirements (CMR)

All new achievement standards have been registered on CMR 0233.

Impact of changes on [Exclusions List](#)

For transition purposes, the following exclusions will apply for new achievement standards.

Achievement standard	Excluded against each of these standards
91387	6341, 90694
91390	90780
91391	6344, 90698
91392	90700
91393	90696

Review Categories and changes to classification, title, level, and credits

The following summary shows the changes made to the standards as a result of the review. All changes are in **bold**. Where a new or a new version of an externally assessed achievement standard is registered, the following designation appears after the title **[Externally Assessed]**.

Key to review category	
A	Dates changed, but no other changes are made - the new version of the standard carries the same ID and a new version number
B	Changes made, but the overall outcome remains the same - the new version of the standard carries the same ID and a new version number
C	Major changes that necessitate the registration of a replacement achievement standard with a new ID
D	Achievement standard will expire and not be replaced

Externally assessed achievement standards categorised as category C or D expire at the end of	December 2012
--	----------------------

Internally assessed achievement standards and unit standards categorised as category C or D expire at the end of	December 2013
---	----------------------

Sciences > Science > Chemistry

ID	Ref	Title	Level	Credit	Review Category
6340		Evaluate the interaction of a chemical process with society and/or the environment	3	3	D
6341		Carry out a practical investigation into variations in the concentration of a chemical substance	3	6	C
90694	3.1	Carry out an extended practical investigation involving quantitative analysis	3	4	C
91387	3.1	Carry out an investigation in chemistry involving quantitative analysis	3	4	
6343		Explain periodic trends in the properties of elements and compounds	3	4	D
6344		Investigate the characteristic properties and reactions of organic substances	3	5	C
90698	3.5	Describe aspects of organic chemistry	3	5	C
91391	3.5	Demonstrate understanding of the properties of organic compounds [Externally Assessed]	3	5	
8948		Calculate the enthalpy change associated with chemical reactions	3	2	D
8950		Predict the formation of precipitates of sparingly soluble substances	3	2	D
90695	3.2	Determine the concentration of an oxidant or reductant by titration	3	2	D

ID	Ref	Title	Level	Credit	Review Category
90696	3.3	Describe oxidation-reduction processes	3	3	C
91393	3.7	Demonstrate understanding of oxidation-reduction processes	3	3	
90700	3.7	Describe properties of aqueous systems	3	5	C
91392	3.6	Demonstrate understanding of equilibrium principles in aqueous systems [Externally Assessed]	3	5	
90780	3.4	Describe properties of particles and thermochemical principles	3	5	C
91390	3.4	Demonstrate understanding of thermochemical principles and the properties of particles and substances [Externally Assessed]	3	5	
91388	3.2	Demonstrate understanding of spectroscopic data in chemistry	3	3	New
91389	3.3	Demonstrate understanding of chemical processes in the world around us	3	3	New

Appendix

Development of Level 3 Chemistry Standards

The Level 3 Chemistry achievement standards have been developed to align the outcomes with level 8 of the Material World strand of the Science Learning Area of the NZC and, where appropriate, the Nature of Science (NoS) strand.

The intention of the Achievement Aims of the Material World strand is that all three achievement objectives along with NoS objective regarding the use of language, symbols and conventions would be integrated in each context explored in a chemistry teaching programme. This would encourage students to use their understanding of the structures and interactions of the particles that make up a substance to explain observations of the properties of that substance. They would represent particles and reactions using appropriate symbols and equations and they will relate their knowledge of chemistry to authentic human contexts e.g. biological, historical, economic and environmental.

Chemistry 3.1 AS91387, *Carry out an investigation in chemistry involving quantitative analysis*

Curriculum Links: Material World L8 AO1 - Investigate and measure the chemical and physical properties of a range of groups of substances.

Relationship to current standards

- Is a modified version of previous achievement standard AS3.1.
- Is still internally assessed.
- Planning, and gathering of data, is carried out in groups. Processing of data and writing the report must be done individually.
- Title does not include “Develop” as this is inherent in “carrying out” the investigation.
- Explanatory notes for Merit and Excellence only list the additional requirements to those for the lower levels of achievement.
- The requirement in the current AS3.1 to investigate a possible trend has been extended to include a pattern. Investigating a possible trend is dependent on being able to measure the independent variable. Adding a pattern allows a wider range of choice of independent variable where the variable needs to be able to be described but not necessarily measured.
- Consumer testing/quality control is still not acceptable at this level.
- A clearly identified purpose is required. Students will select their own purpose but the context can be limited by the school/teacher.
- Valid conclusion has been replaced for Merit by a conclusion based on the processed data relevant to the purpose of the investigation.
- Checks for reliability of procedure have been removed to reduce the time needed for this assessment and because it has limited meaning statistically. Instead reliability should be inherent in the evaluation, which explains why the data should be trusted.
- The logbook remains central to assessment – it is an essential working document that shows evidence of the ongoing process.
- Control of significant variables has been moved up to Merit as part of a procedure to develop quality data.

- Merit now includes discussion of procedure and reliability of data because there is a connection between these two. Merit also requires recognition of the effect of the procedure on reliability of data.
- It is expected that bulk solutions will be provided for analysis to cut down workload for students, however students need to standardise the standard solution(s) they are using for progression to Merit and Excellence.
- A maximum limit of 1000 words is suggested for manageability.

Chemistry 3.2 AS91388, *Demonstrate understanding of spectroscopic data in chemistry*

Curriculum Links: Material World L8 AO1 - Investigate and measure the chemical and physical properties of a range of groups of substances. AO3 - Apply knowledge of chemistry to explain aspects of the natural world and how chemistry is used in society to meet needs, resolve issues, and develop new technologies.

Relationship to current standards

- This is a new standard developed to respond to sector feedback that modern techniques in chemistry are introduced at this level.
- Internally assessed.
- There are three qualitative techniques that could be assessed. Only one is needed for Achievement. At this level students are able to interpret the spectra of simple organic molecules.
- For Merit students are required to link data from three different spectroscopic techniques to the structural features of given molecules.
- For Excellence they will be required to solve the structures of simple organic molecules using data from three different spectroscopic techniques.
- A wide range of possible functional groups is given to allow for a variety of assessment contexts.
- Tables will be provided for interpretation of data e.g. fragments (mass spectrometry), characteristic absorptions (IR) and shifts (NMR).
- A portfolio would be an appropriate way to assess against this standard as aspects of it may be taught and assessed at different times in the teaching programme.
- Examples of integrated problems:
<http://orgchem.colorado.edu/Spectroscopy/Spectroscopy.html>.

Chemistry 3.3 AS91389, *Demonstrate understanding of chemical processes in the world around us*

Curriculum Links: Material World L8 AO3 - Apply knowledge of chemistry to explain aspects of the natural world and how chemistry is used in society to meet needs, resolve issues, and develop new technologies.

Nature of Science L8 AO1- Understand that scientists have an obligation to connect their new ideas to current and historical scientific knowledge.

Nature of Science L8 AO2 - Develop and carry out investigations that extend their science knowledge, including developing their understanding of the relationship between investigations and scientific theories and models.

Nature of Science L8 AO3 - Use accepted science knowledge, vocabulary, symbols, and conventions when evaluating accounts of the natural world and consider the wider implications of the methods of communication and/or representation employed.

Relationship to current standards

- This is a new standard.
- This is individually assessed.
- It is not intended that this be a research-based standard. Information is to be provided by the teacher for students to process and interpret to make connections between a recent discovery or development in chemistry and the related chemical principles or processes.
- Information could be from a list of websites or written material.
- The use of correct formulae and balanced equations where appropriate is implicit in the requirement that chemistry vocabulary, symbols and conventions are used.
- At Achieved level the account given must be supported by the use of chemistry vocabulary, symbols, conventions, and equations.
- Merit level requires explanations that integrate chemistry vocabulary, symbols and conventions.
- Excellence level requires consistent integration of chemistry vocabulary, symbols and conventions.

Chemistry 3.4 AS91390, *Demonstrate understanding of thermochemical principles and the properties of particles and substances*

Curriculum Links: Material World L8 AO1 - Investigate and measure the chemical and physical properties of a range of groups of substances

Material World L8 AO2 - Relate properties of matter to structure and bonding. Develop an understanding of and use the fundamental concepts of chemistry (for example, equilibrium and thermochemical principles) to interpret observations.

Relationship to current standards

- Transition metals have been removed because this requires an understanding of the d-orbitals, which is outside the scope of this standard.
- Emphasis at Merit and Excellence is on links between the properties of particles and the properties (now defined) of the substances they form.
- Bond enthalpy calculations has been moved to Level 2.
- The concept of entropy has been introduced so that it can be considered alongside enthalpy in discussions of spontaneity of reactions. Entropy calculations are not included.
- Writing equations and correct use of formulae have not been specified as this is implicit in the requirement that chemistry vocabulary, symbols and conventions are used.

Chemistry 3.5 AS91391, *Demonstrate understanding of structure and reactivity of organic compounds*

Curriculum Links: Material World L8 AO1 - Investigate and measure the chemical and physical properties of a range of groups of substances.

Material World L8 AO2 - Relate properties of matter to structure and bonding. Develop an understanding of and use the fundamental concepts of chemistry (for example, equilibrium and thermochemical principles) to interpret observations.

Relationship to current standards

- Retains most of the material from current AS 3.5.
- Esters are now introduced at this level as one of the carboxylic acid derivatives.
- The terms constitutional isomers and stereoisomers are used to more accurately describe isomers. Stereoisomers will include optical and cis-trans isomers.
- Major and minor products of elimination are now included.
- Reduction of aldehydes using NABH₄ has been introduced to give more scope for reaction pathways and provide reversal of some oxidation reactions.
- ZnCl₂/HCl and PCl₃ have been removed as reagents for substitution reactions.
- Emphasis at Merit and Excellence is on links between structure, functional groups, physical properties and the reactivity of organic compounds.
- Writing equations and correct use of formulae have not been specified as this is implicit in the requirement that chemistry vocabulary, symbols and conventions are used.

Chemistry 3.6 AS91392, *Demonstrate understanding of equilibrium principles in aqueous systems*

Curriculum Links: Material World L8 AO1 - Investigate and measure the chemical and physical properties of a range of groups of substances.

Material World L8 AO2 - Relate properties of matter to structure and bonding. Develop an understanding of and use the fundamental concepts of chemistry (for example, equilibrium and thermochemical principles) to interpret observations.

Relationship to current standards

- Retains all aspects of current AS 3.6.
- Writing equations and correct use of formulae have not been specified as this is implicit in the requirement that chemistry vocabulary, symbols and conventions are used.

Chemistry 3.7 AS91393, *Demonstrate understanding of oxidation-reduction processes*

Curriculum Links: Material World L8 AO1 - Investigate and measure the chemical and physical properties of a range of groups of substances.

Relationship to current standards

- Retains material from current AS 3.7 but is now assessed internally.
- The decision to keep this as a separate achievement standard rather than incorporating it into one of the three external standards was based on sector feedback.
- Electrolysis has been moved from Level 2 to Level 3, where it is more appropriate to consider it alongside electrochemical cells.
- The major emphasis of this standard is on electrochemical cells and the application of these in understanding the spontaneity of chemical reactions and relative strength of oxidants and reductants.
- There is scope for practical work to be part of the assessment.
- Writing equations and half equations has not been specified as it is implicit in the requirement that chemistry vocabulary, symbols and conventions are used.
- Emphasis at Merit and Excellence is on links between oxidation-reduction processes, observations, equations and calculations.

- Knowledge of the appearance of common oxidants and reductants is no longer a requirement for achievement of the standard.
- Appearance of oxidants and reductants, and standard reduction potentials, must be provided.
- Knowledge of preferential discharge in electrolytic cells is not required.
- Appropriate calculations for this standard include those using electrode potentials and the relationship between oxidation numbers and equation stoichiometry.
- A written test would be an appropriate way of assessing this standard.