Field Sciences

Review of *Chemistry* Level 2 achievement and unit standards

Unit standards

Subfield	Domain	ID
Science	Chemistry	6332, 6338, 6339, 8940-8947

Achievement standards

Domain	ID	Subject reference
Chemistry	90305	Chemistry 2.1
	90306	Chemistry 2.2
	90308	Chemistry 2.4
	90309	Chemistry 2.5
	90310	Chemistry 2.6
	90311	Chemistry 2.7
	90763	Chemistry 2.3

The Ministry of Education and NZQA National Qualifications Services have completed a review of the achievement and unit standards listed above.

New Registration date **November 2011**

Date new versions published **November 2011**

Planned review date **December 2014**

Summary of review and consultation process

In 2008 the Ministry of Education (MoE) and NZQA began to review achievement and unit standards in light of the revised New Zealand Curriculum (NZC). This Alignment of Standards (AoS) review also addressed duplication of outcomes, credit parity, fairness, consistency, and coherence. The AoS review was guided by the revised NZC itself and the Principles for Standards Review. A copy of the NZC is available at: http://nzcurriculum.tki.org.nz/Curriculum-documents/The-New-Zealand-Curriculum.

Teacher subject associations were involved in the review, and draft achievement standards were the focus of wide consultation, especially with secondary schools and teachers. Extensive resources, including student exemplars, were also developed to support these standards, and are available on the MoE and/or the NZQA websites.

The review of unit standards included consultation with tertiary providers to assess continued relevance and likely future use of the standards. Unit standards that duplicate achievement standard outcomes and those without the likelihood of future tertiary use were recommended for expiry.

National consultation was undertaken in 2010, with the results analysed by Research New Zealand. The responses were generally positive.

The review of these Level 2 unit and achievement standards was completed in time for implementation in schools in 2012. The review of unit and achievement standards at

Level 1 was completed in time for implementation in schools in 2011. Standards at Level 3 will be implemented in 2013.

Main changes resulting from the review

- All NZC Level 7 (NZQF Level 2) 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.
- Achievement standard 90311 [Externally Assessed] was replaced by achievement standard 91167 [Internally Assessed]. See table below.

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

Impact on Consent and Moderation Requirements (CMR)
(Formerly known as AMAP)

All new achievement standards have been registered on CMR 0233.

Impact of changes on NCEA Exclusions List

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

Achievement standard	Excluded against each of these standards
91161	8940, 90306, 90763
91162	90305
91164	8944, 90308
91165	90309
91166	90310
91167	8947, 90311

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 expire at the end of	**December 2011**

Internally assessed achievement standards and unit standards categorised as category C or D expire at the end of	**December 2012**

Sciences > Science > Chemistry

ID	Title	Level	Credit	Review Category
6332	Appreciate how groups of related chemical substances meet the needs of society	2	3	D
6338	Characterise the behaviour of weak and strong acids and bases	2	3	D
6339	Prepare or isolate consumer products and compare their properties to a commercial equivalent	2	2	D
8940	Carry out an acid-base volumetric analysis	2	3	C
90306	Carry out an acid-base volumetric analysis	2	3	C
90763	Solve simple quantitative chemical problems	2	2	C
91161	**Carry out quantitative analysis**	**2**	**4**	
8941	Carry out gravimetric or colorimetric analyses	2	2	D
8942	Characterise the nature of chemical systems at equilibrium	2	2	D
8943	Investigate enthalpy changes of chemical reactions	2	2	D
8944	Relate properties of chemical substances to their structure and bonding	2	3	C
90308	Describe the nature of structure and bonding in different substances	2	4	C
91164	**Demonstrate understanding of bonding, structure, properties and energy changes [Externally Assessed]**	**2**	**5**	
8945	Investigate periodic trends in the properties of a series of inorganic compounds	2	2	D
8946	Characterise the properties and reactions of selected organic families	2	5	D
90305	Carry out qualitative analysis	2	3	C
91162	**Carry out procedures to identify ions present in solution**	**2**	**3**	
90309	Describe the structural formulae and reactions of compounds containing selected organic functional groups	2	4	C
91165	**Demonstrate understanding of the properties of selected organic compounds [Externally Assessed]**	**2**	**4**	
90310	Describe thermochemical and equilibrium principles	2	5	C
91166	**Demonstrate understanding of chemical reactivity [Externally Assessed]**	**2**	**4**	

ID	Title	Level	Credit	Review Category
8947	Characterise oxidation-reduction reactions	2	3	C
90311	Describe oxidation-reduction reactions	2	3	C
91167	**Demonstrate understanding of oxidation-reduction**	**2**	**3**	
91163	**Demonstrate understanding of the chemistry used in the development of a current technology**	**2**	**3**	**New**

Appendix

Development of L2 Chemistry Standards

The Level 2 Chemistry achievement standards have been developed to align the outcomes with Level 7 of the Material World strand of the Science Learning Area of the NZC and, where appropriate, the Nature of Science strand.

The intention of the achievement objectives of the Material World strand is that most courses of study in chemistry will incorporate more than one objective and usually also include the nature of science objective regarding the use of language, symbols and conventions. Hence it is expected that students will use their understanding of the structures and interactions of the particles that make up a substance to explain observations of the properties of these substances. They will represent these using appropriate symbols and equations. It is also expected that they will relate their knowledge of chemistry to authentic human contexts e.g. biological, historical, economic, and environmental.

AS91161 – Chemistry 2.1: *Carry out quantitative analysis*

Curriculum Links: Material World L7 AO1 - Investigate and measure the chemical and physical properties of groups of substances

Relationship to earlier standards

- Combines standard 90306 and related aspects of 90763.
- Is still internally assessed.
- Practical component (titration) is retained but other aspects of volumetric analysis or gravimetric analysis and related calculations may be included e.g. making standard solutions.
- Increased number of credits (from 90306) reflects the wider range of calculations now expected.
- For achievement of the practical component the number of titres required has been increased from 2 to 3 to give a more statistically appropriate set of data.
- Writing equations and correct use of formulae has not been specified in the standard as it is implicit in the requirement that chemistry vocabulary, symbols and conventions are used.
- Calculations may be included in other achievement standards where appropriate.

AS91162 – Chemistry 2.2: *Carry out procedures to identify ions in solution*

Curriculum Links: Material World L7 AO1 - Investigate and measure the chemical and physical properties of groups of substances

Relationship to earlier standards

- Replaces standard 90305.
- Internally assessed.
- A procedure is to be supplied. While this will usually be a flow chart the wording has changed to allow for other options.

- Writing equations and correct use of formulae has not been specified as it is implicit in the requirement that chemistry vocabulary, symbols and conventions are used.
- Distinguishing between pairs of ions has been removed. This was intended to provide evidence for achieved only. However, as this often required evidence up to formation of complex ions, limiting possible judgement to achieved was considered 'unfair' to students. However, it was not intended to provide opportunity for merit and excellence.

AS91163 – Chemistry 2.3: *Demonstrate understanding of the chemistry used in the development of a current technology*

Curriculum Links: Material World L7 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 L7 AO1- Understand that scientists have an obligation to connect their new ideas to current and historical scientific knowledge.
Nature of Science L7 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 L7 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 earlier standards

- This is a new standard to provide an assessment opportunity for the chemistry in society achievement aim.
- Information will 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.
- Students may supplement the provided material with their own research however it is not intended that this is to be a research based standard.
- The use of correct formulae and balanced equations where appropriate is implicit in the requirement that chemistry vocabulary, symbols and conventions are used.

AS91164 – Chemistry 2.4: *Demonstrate understanding of bonding, structure and energy change*

Curriculum Links: Material World L7 AO1 - Investigate and measure the chemical and physical properties of groups of substances
Material World L7 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 earlier standards

- Retains all aspects of 90308.
- Energy in reactions and physical changes has been moved to this standard from 90310 because of the relationship between bonding (including

intermolecular forces), bond energy and the energy of reactions and physical changes.
- Includes endothermic and exothermic reactions, energy of reactions and physical changes associated with the making and breaking of bonds (including intermolecular forces).
- Calculations related to energy changes have been included such as using a balanced equation to determine the energy released from a given amount of reactant and simple bond energy calculations
- Writing equations and correct use of formulae has not been specified as it is implicit in the requirement that chemistry vocabulary, symbols and conventions are used.

AS91165 – Chemistry 2.5: *Demonstrate understanding of the properties of selected organic compounds*

Curriculum Links: Material World L7 AO1 - Investigate and measure the chemical and physical properties of groups of substances.
Material World L7 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 earlier standards
- Retains most of the material from 90309.
- Esters and triglycerides have been removed and put into Level 3 to be included with the other carboxylic acid derivatives.
- Amines have been transferred from Level 3 to allow for acid-base reactions with carboxylic acid and also to increase scope of substitution reactions.
- Reaction of alcohols with hydrogen halides (not just hydrogen chloride) added to increase the scope of reactions.
- Substitution of alkyl halides with ammonia to make amine added to allow for reaction schemes that incorporate amines.
- Writing equations and correct use of formulae has not been specified as it is implicit in the requirement that chemistry vocabulary, symbols and conventions are used.

AS91166 – Chemistry 2.6: *Demonstrate understanding of chemical reactivity*

Curriculum Links: Material World L7 AO1 - Investigate and measure the chemical and physical properties of groups of substances.
Material World L7 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 earlier standards
- Retains rates of reactions and equilibrium principles from 90310.
- Rates of reaction is in Level 6 of the material world achievement objectives but assessment in the Level 1 achievement standards only assesses effect of surface area and concentration. Effects of temperature and catalysts have been included at this level since the ideas are more sophisticated and require and understanding of activation energy. Both these effects need to be considered alongside equilibrium principles when investigating chemical reactivity.

- Writing equations and correct use of formulae has not been specified as it is implicit in the requirement that chemistry vocabulary, symbols and conventions are used.

AS91167 – Chemistry 2.7: *Demonstrate understanding of oxidation reduction*

Curriculum Links: Material World L7 AO1 - Investigate and measure the chemical and physical properties of groups of substances.
Material World L7 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 earlier standards

- Retains material from 90311 but is now assessed internally since only three standards can now be externally assessed.
- 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. It was considered that combining with any of the other standards would make the standard too big and that there is currently the need to reduce the amount of material in the external examinations.
- Electrolytic cells have been moved to Level 3 where it is more appropriate to consider them alongside electrochemical cells.
- Specific reference to ability of halogens to act as oxidants in reactions with other elements, water or halide ions has been removed as the necessary reactions are indicated in the list of reductants and oxidants given in explanatory note 5.
- The title does not have the term ‘reactions’ as in the draft matrix and the current standard to allow the concepts of oxidation or reduction to be explored independently (i.e. half reactions) and not being limited to a complete reaction.
- Writing equations and half equations has not been specified as it is implicit in the requirement that chemistry vocabulary, symbols and conventions are used.
- ‘State’ has been removed from the required knowledge of oxidants and reductants as it is implicit in ‘appearance.’
- CO has been removed from the list of reductants because it is not practical to use it in school laboratories.
- Sulfite and hydrogensulfite has been included with SO_2 for completeness.
- H_2O_2 has been included as both an oxidant and reductant to increase scope of allowed reactions.
- Calculations have been included to give more scope to the standard and because they are appropriate to this topic. Appropriate calculations will use the stoichiometry of balanced oxidation-reduction equations to predict amounts of reactants and products.