

Achievement Standard

Subject Reference	Chemistry 3.4		
Title	Demonstrate understanding of thermochemical principles and the properties of particles and substances		
Level	3	Credits	5
		Assessment	External
Subfield	Science		
Domain	Chemistry		
Status	Registered	Status date	04 December 2012
Planned review date	31 December 2019	Date version published	17 November 2016

This achievement standard involves demonstrating understanding of thermochemical principles and the properties of particles and substances.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
<ul style="list-style-type: none"> Demonstrate understanding of thermochemical principles and the properties of particles and substances. 	<ul style="list-style-type: none"> Demonstrate in-depth understanding of thermochemical principles and the properties of particles and substances. 	<ul style="list-style-type: none"> Demonstrate comprehensive understanding of thermochemical principles and the properties of particles and substances.

Explanatory Notes

- 1 This achievement standard is derived from *The New Zealand Curriculum*, Learning Media, Ministry of Education, 2007, Level 8. The standard is aligned to the Material World achievement objectives:

Investigate and measure the chemical and physical properties of a range of groups of substances.

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.

It is also related to the material in the *Teaching and Learning Guide for Chemistry*, Ministry of Education, 2010 at <http://seniorsecondary.tki.org.nz>.

This standard is also derived from *Te Marautanga o Aotearoa*. For details of *Te Marautanga o Aotearoa* achievement objectives to which this standard relates, see the [Papa Whakaako](#) for the relevant learning area.

- 2 *Demonstrate understanding* involves describing, identifying, naming, drawing, and giving an account of the properties of particles, the properties of substances they form, and thermochemical principles. This requires the use of chemistry vocabulary, symbols, and conventions and may include related calculations.

Demonstrate in-depth understanding involves making and explaining links between the properties of particles, the properties of substances they form, thermochemical principles, and related calculations. This requires explanations that use chemistry vocabulary, symbols, and conventions.

Demonstrate comprehensive understanding involves elaborating, justifying, relating, evaluating, comparing and contrasting, or analysing links between the properties of particles, the properties of substances they form, thermochemical principles, and related calculations. This requires the consistent use of chemistry vocabulary, symbols, and conventions.

- 3 *Properties of particles* are limited to:
- electron configuration of atoms and ions of the first 36 elements (using *s,p,d* notation)
 - periodic trends in atomic radius, ionisation energy, and electronegativity, and comparison of atomic and ionic radii
 - Lewis structures and shapes (up to six electron pairs about the central atom for molecules and polyatomic ions, including those with multiple bonds), polarity of molecules
 - attractive forces between atoms, ions, and molecules. These will include ionic bonds, covalent bonds, and intermolecular attractions due to temporary dipoles and permanent dipoles (including hydrogen bonding).
- 4 *Properties of substances* are limited to:
- melting point, boiling point and solubility
 - enthalpy and entropy changes associated with spontaneity in chemical reactions (entropy calculations are not required).
- 5 *Thermochemical principles* include:
- specific heat capacity
 - phase changes
 - $\Delta_c H^\circ$, $\Delta_f H^\circ$, $\Delta_r H^\circ$, $\Delta_{vap} H^\circ$, $\Delta_{sub} H^\circ$, and $\Delta_{fus} H^\circ$
 - Hess's Law including application of $\Delta_r H = \sum \Delta_f H(\text{products}) - \sum \Delta_f H(\text{reactants})$ and related calculations.
- 6 Assessment Specifications for this achievement standard can be accessed through the Chemistry Resources page found at <http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/>.

Replacement Information

This achievement standard replaced AS90780.

Quality Assurance

- 1 Providers and Industry Training Organisations must have been granted consent to assess by NZQA before they can register credits from assessment against achievement standards.
- 2 Organisations with consent to assess and Industry Training Organisations assessing against achievement standards must engage with the moderation system that applies to those achievement standards.

Consent and Moderation Requirements (CMR) reference

0233