

13 CHEMISTRY
13 MĀTAI MATŪ
COURSE INFORMATION



2016

Chemistry Achievement Aims

In studying chemistry, students will use their developing scientific knowledge, skills and attitudes to:

1. Investigate and develop an understanding of the ways materials and chemical processes interact with people and the environment;
2. carry out a range of practical investigations and use this and other information to explore chemical behaviour;
3. understand important concepts in chemistry and major patterns in chemical behaviour.

In studying chemistry, students will further develop their scientific investigative skills and attitudes. In particular students will be assessed on the following skills and attitudes:

Focusing and Planning

Information Gathering

Processing and interpreting

Reporting

Assessment Policy

You need to be familiar with the procedures outlined in the student handbook to NCEA, and understand that the school's assessment policy will apply to this course.

Further assessment Opportunities

ONE further assessment opportunity will be made available for the internal assessments AS 91393 (Redox) and 91388 (Spectroscopy). There will be no further assessment opportunity for AS 91389 although a resubmission opportunity **may** be available.

Some Useful Points and Resources

- At all times during this course you will be expected to recall the chemistry you studied in Year 12. It is essential to keep last year's notes so you can refer to them before each new unit of work.
- Practise and always use appropriate terms, chemical formulae and equations to describe investigations.
- Practise writing chemical equations at every opportunity!
- Practise using chemistry language to explain chemical principles.
- Relate observations to chemical concepts, and use symbols and equations to help you explain these.
- Go over your notes after each lesson and ASK FOR HELP if you don't understand something.

TABLE OF IONS

Positive Ions

Negative Ions

	2^+	3^+		1^-	2^-	3^-
H^{1+} hydrogen ion	Fe^{2+} Iron (II) ion	Fe^{3+} Iron (III) ion		Cl^{1-} Chloride ion	CO_3^{2-} Carbonate ion	PO_4^{3-} Phosphate ion
K^{1+} Potassium ion	Mg^{2+} Magnesium ion	Al^{3+} Aluminium ion		NO_3^{1-} Nitrate ion	O^{2-} oxide ion	N^{3-} nitride ion
Na^{1+} Sodium ion	Ca^{2+} Calcium ion	Cr^{3+} Chromium ion		HCO_3^{1-} hydrogen carbonate ion	S^{2-} Sulfide ion	P^{3-} phosphide ion
NH_4^{1+} Ammonium ion	Zn^{2+} Zinc ion			OH^{1-} Hydroxide ion	SO_4^{2-} Sulfate ion	
Ag^{1+} Silver ion	Pb^{2+} Lead ion			I^{1-} Iodide ion	$Cr_2O_7^{2-}$ Dichromate ion	
Cu^{1+} Copper (1) ion	Cu^{2+} Copper (II) ion			MnO_4^{1-} Permanganate ion	SO_3^{2-} Sulfite ion	
	Ba^{2+} Barium ion			Br^{1-} Bromide ion	CrO_4^{2-} Chromate ion	
	Sn^{2+} Tin ion			SCN^{1-} Thiocyanate ion	$S_2O_3^{2-}$ thiosulfate ion	
				OCl^{1-} hypochlorite ion		
				BrO_3^{1-} Bromate ion		
				ClO_3^{1-} Chlorate ion		
				IO_3^{1-} Iodate ion		

Chemistry Level 3

Yr 13

One week before each assessment you will be reminded

* what learning outcomes will be assessed

* how they will be assessed

* how the assessment contributes towards your report.

There will be **one** resubmission and **one** reassessment held outside of normal class time, for each Internal, except AS91387 (3.1).

Term	Week	Date	ASSESSMENT TASK	Int/Ext	Credits	Assessment
1	1					
	2					
	3					
	4					
	5					
	6					
	7		Particles and thermochemistry 91390 v1 (3.4)	Ext	5	Test 1hr
	8					
	9					
	10					
	11					

2	1		Write a Report 91389 (3.3) (Optional)	<i>Int</i>	3	Report
	2					
	3		Describe organic compounds 91391 v1 (3.5)	Ext	5	Test 1hr
	4					
	5					
	6					
	7		Spectroscopy 91388 v1 (3.2)	Int	3	Test 1 Hr
	8					
	9					
	10					

3	1					
	2		Aqueous solns and equilibria 91392 v1 (3.6)	Ext	5	Test 1hr
	3					
	4		School Exams (3.4, 3.5, 3.6,)			3hr Exam
	5					
	6		<i>Tournament week</i>			
	7					
	8					
	9		Redox Internal 91393 v1 (3.7)	Int	3	Practical Test

4	1		Techniques for writing Merit and Excellence answers			
	2		Revision			
	3		Revision			
	4		Revision			

Internally Assessed Standards

Achievement Standard

Subject Reference	Chemistry 3.2				
Title	Demonstrate understanding of spectroscopic data in chemistry				
Level	3	Credits	3	Assessment	Internal
Subfield	Science				
Domain	Chemistry				
Status	Registered	Status date	04 December 2012		
Planned review date	31 December 2016	Date version published	04 December 2012		

This achievement standard involves demonstrating understanding of spectroscopic data in chemistry.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
<ul style="list-style-type: none">Demonstrate understanding of spectroscopic data in chemistry.	<ul style="list-style-type: none">Demonstrate in-depth understanding of spectroscopic data in chemistry.	<ul style="list-style-type: none">Demonstrate comprehensive understanding of spectroscopic data in chemistry.

Explanatory Notes

- Demonstrate understanding of spectroscopic data* involves:
 - identifying discrete aspects of the structure of organic molecules using teacher provided spectroscopic data.

Demonstrate in-depth understanding involves:

 - determining the structure of organic molecules using spectroscopic data.

Demonstrate comprehensive understanding involves:

 - justifying the structure of organic molecules by integrating spectroscopic data.
- Spectroscopic data is limited to that collected from mass, infrared (IR) and ^{13}C nuclear magnetic resonance (NMR) spectroscopy.
- Organic molecules are limited to alkanes, alkenes, alcohols, haloalkanes, amines, aldehydes, ketones, carboxylic acids, amides, acid chlorides and esters.
- Aspects of structure are limited to molar mass and molecular formulae, functional groups, and the carbon framework including structural isomers.

Achievement Standard

Subject Reference	Chemistry 3.7				
Title	Demonstrate understanding of oxidation-reduction processes				
Level	3	Credits	3	Assessment	Internal
Subfield	Science				
Domain	Chemistry				
Status	Registered	Status date	04 December 2012		
Planned review date	31 December 2016	Date version published	04 December 2012		

This achievement standard involves demonstrating understanding of oxidation-reduction processes.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
<ul style="list-style-type: none">Demonstrate understanding of oxidation-reduction processes.	<ul style="list-style-type: none">Demonstrate in-depth understanding of oxidation-reduction processes.	<ul style="list-style-type: none">Demonstrate comprehensive understanding of oxidation-reduction processes.

Explanatory Notes

- 1 *Demonstrate understanding* involves describing oxidation-reduction processes and may involve calculations. This requires the use of chemistry vocabulary, symbols, and conventions.

Demonstrate in-depth understanding involves making and explaining links between oxidation-reduction processes, observations, equations and calculations. This requires explanations that use chemistry vocabulary, symbols, and conventions.

Demonstrate comprehensive understanding involves comparing and contrasting, and justifying, links between oxidation-reduction processes, observations, equations and calculations. This requires the consistent use of chemistry vocabulary, symbols, and conventions.

- 2 *Oxidation-reduction processes* involve the use of the relative strengths of oxidants and reductants. This includes the use of reduction potentials and spontaneity of reactions.
- 3 *Processes* include reactions in electrochemical and electrolytic cells.
- 4 Calculations are limited to those involving electrode potentials.

Achievement Standard

Subject Reference	Chemistry 3.3				
Title	Demonstrate understanding of chemical processes in the world around us				
Level	3	Credits	3	Assessment	Internal
Subfield	Science				
Domain	Chemistry				
Status	Registered	Status date	04 December 2012		
Planned review date	31 December 2016	Date version published	04 December 2012		

This achievement standard involves demonstrating understanding of chemical processes in the world around us.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
<ul style="list-style-type: none">Demonstrate understanding of chemical processes in the world around us.	<ul style="list-style-type: none">Demonstrate in-depth understanding of chemical processes in the world around us.	<ul style="list-style-type: none">Demonstrate comprehensive understanding of chemical processes in the world around us.

Explanatory Notes

- 5 *Demonstrate understanding* involves processing and interpreting given information to identify, describe, and give an account of chemical processes occurring in the natural world or developed in response to an issue or need. The account given must be supported by the use of chemistry vocabulary, symbols, conventions, and equations.

Demonstrate in-depth understanding involves making and explaining links between chemical processes, and the consequences of the chemical processes for the environment or people. This requires explanations that integrate chemistry vocabulary, symbols, conventions, and equations.

Demonstrate comprehensive understanding involves an evaluation of the impact of, and issues that have arisen from, the chemical processes. This involves elaborating on, comparing and contrasting, or analysing the links between the chemical processes and their consequences. This requires the consistent integration of chemistry vocabulary, symbols, conventions, and equations.

- 6 *Chemical processes in the world around us* include either the chemistry related to an environmental issue or the chemistry involved in the development of new technology to meet a societal need. Examples of environmental issues may include an aspect of the greenhouse effect, ozone depletion, acidification of oceans, acid rain, volcanic eruptions, or pollution. Examples of technologies may include an aspect of polymers, energy production, pharmaceuticals, or food production.

Externally Assessed Standards 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 2016	Date version published	04 December 2012		

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 *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.

- 2 *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).
- 3 *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).
- 4 *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.

Achievement Standard

Subject Reference	Chemistry 3.5				
Title	Demonstrate understanding of the properties of organic compounds				
Level	3	Credits	5	Assessment	External
Subfield	Science				
Domain	Chemistry				
Status	Registered	Status date	04 December 2012		
Planned review date	31 December 2016	Date version published	04 December 2012		

This achievement standard involves demonstrating understanding of the properties of organic compounds.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
<ul style="list-style-type: none"> • Demonstrate understanding of the properties of organic compounds. 	<ul style="list-style-type: none"> • Demonstrate in-depth understanding of the properties of organic compounds. 	<ul style="list-style-type: none"> • Demonstrate comprehensive understanding of the properties of organic compounds.

Explanatory Notes

- 1 *Demonstrate understanding* involves naming using IUPAC conventions (no more than eight carbons in the longest chain) and/or drawing structural formulae of organic compounds and giving an account of their physical properties and/or reactivity. This requires the use of chemistry vocabulary, symbols, and conventions.

Demonstrate in-depth understanding involves making and explaining links between structure, functional groups, physical properties, and reactivity of organic compounds. This requires explanations that use chemistry vocabulary, symbols, and conventions.

Demonstrate comprehensive understanding involves elaborating, justifying, relating, evaluating or comparing and contrasting the links between the structure, functional groups, physical properties and/or reactivity of organic compounds. This requires the consistent use of chemistry vocabulary, symbols, and conventions.

- 2 *Organic compounds* are limited to those containing one or more of the following functional groups: alkene, haloalkane, amine, alcohol, aldehyde, ketone, carboxylic acid, ester (including triglycerides), acyl chloride, and amide.
- 3 Structure includes functional groups and isomerism (constitutional isomers and stereoisomers).
- 4 Reactivity of organic compounds is limited to:
 - substitution reactions using the following reagents: concentrated HCl, HBr, SOCl₂, NaOH, KOH (in alcohol or aqueous solution), concentrated NH₃, primary amines, primary alcohols/H⁺, H₂O/H⁺, H₂O/OH⁻ (Substitution reactions include esterification, condensation, hydrolysis, and polymerisation.)
 - oxidation reactions using the following reagents: MnO₄⁻/H⁺, Cr₂O₇²⁻/H⁺, Tollens', Fehling's and Benedict's. Reduction of aldehydes and ketones with NaBH₄
 - elimination reactions using the following reagents: KOH in alcohol and concentrated H₂SO₄ (includes major and minor products from asymmetric alcohols and haloalkanes)
 - polymerisation reactions involving formation of polyesters and polyamides including proteins
 - addition reactions of alkenes (used for the identification of the products of elimination reactions).
- 5 Physical properties of organic compounds may be used to distinguish between organic compounds and are limited to:
 - solubility
 - melting point and boiling point
 - rotation of plane-polarised light.

Achievement Standard

Subject Reference		Chemistry 3.6			
Title		Demonstrate understanding of equilibrium principles in aqueous systems			
Level	3	Credits	5	Assessment	External
Subfield	Science				
Domain	Chemistry				
Status	Registered	Status date	04 December 2012		
Planned review date	31 December 2016	Date version published	04 December 2012		

This achievement standard involves demonstrating understanding of equilibrium principles in aqueous systems.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
<ul style="list-style-type: none"> • Demonstrate understanding of equilibrium principles in aqueous systems. 	<ul style="list-style-type: none"> • Demonstrate in-depth understanding of equilibrium principles in aqueous systems. 	<ul style="list-style-type: none"> • Demonstrate comprehensive understanding of equilibrium principles in aqueous systems.

Explanatory Notes

- 1 *Demonstrate understanding* involves describing, identifying, and giving an account of aqueous systems using equilibrium principles. This requires the use of chemistry vocabulary, symbols, and conventions and may include related calculations.

Demonstrate in-depth understanding involves using equilibrium principles to explain properties of aqueous systems. This requires explanations that use chemistry vocabulary, symbols, and conventions and may include related calculations.

Demonstrate comprehensive understanding involves elaborating, justifying, relating, evaluating, comparing and contrasting, or analysing properties of aqueous systems in terms of equilibrium principles. This requires the consistent use of chemistry vocabulary, symbols, and conventions and may include related calculations.

- 2 *Aqueous systems* are limited to those involving sparingly soluble ionic solids and acidic and basic solutions (in which proton transfer occurs).
- 3 *Equilibrium principles in aqueous systems* are limited to qualitative descriptions and/or calculations involving:
 - relative concentrations of dissolved species
 - sparingly soluble ionic solids
 - relating solubility to K_s
 - solubility of solids in water and in solutions already containing one of the ions A or B (a common ion) or due to the formation of a complex ion, or the reaction of a basic anion with added acid
 - predicting precipitation or dissolution
 - acidic and basic solutions (includes buffers)
 - acid/base strength, K_a (pK_a)
 - concentration of species present in weak acidic and/or basic solutions (includes buffers)
 - relating concentration of species to pH and conductivity
 - titration curves to represent an acid-base system including selection of indicators (titrations of weak acids with weak bases are excluded).
- 4 Sparingly soluble ionic solids are limited to AB, A_2B and AB_2 types where neither of the ions A nor B reacts further with water.
- 5 Acidic and basic solutions are monoprotic acids, bases, salts, and buffers (those in which the extent of reaction is small so that the equilibrium concentration of a dissolved weak acid or base can be approximated by the initial concentration).