Palmerston North Boys' High School

Advanced Chemistry

Course Information 2019

Welcome to Advanced Chemistry.

Course Structure

The course consists of two level 3 internal Achievement Standards; one of which is optional, Massey 23.101 and scholarship course work.

	Achievement Standard	I/E	Credits
3.1	91387 Carry out an investigation in chemistry involving quantitative analysis	I	4
3.3	91389 Demonstrate understanding of chemical processes in the world around us (optional – done in own time)	I	3
	Total Credits without optional 3.3		**4**
	Total Credits with optional 3.3		**7**

If you want to re-sit any of your level 3 External examinations, this is possible. You will be required to work on these yourself. Revision of the key ideas in each level 3 external examination will occur in the second part of the year through answering Scholarship style questions.

Resources

You will be provided with an ESA Year 13 chemistry textbook and the level one University chemistry textbook. Additional notes will be printed and provided throughout the year.

Electronic resources and links to useful websites for each topic can be found on Stratus.

You will be able to use the 'BestChoice' interactive website. This website contains summary information and interactive questions for each Achievement Standard and for Scholarship revision.

Practical Work:

Experiments for 3.1 will be completed as necessary. Students Enrolled into the Massey University Chemistry paper will need to attention laboratory sessions at Massey outside of school hours. You will need to buy your own lab coat and safety classes.

INTERNAL ASSESSMENT PROCEDURES

AUTHENTICITY

All work submitted for NCEA assessment must be the student's own work. Tasks not possible to authenticate will not be set. Furthermore, students must not directly assist or provide work for others to copy as part of any assessment task.

All students have on their files an authenticity statement that they have signed. **Any cases of plagiarism will result in an immediate loss of credits and disciplinary action being taken.**

EXTENSIONS and MISSED ASSESSMENTS

Students are responsible for ensuring any work submitted electronically for an assessment is received successfully by their teacher.

Extensions will be considered by the Head of Department on an individual basis and will be granted after taking into account the following:

- The nature of the task, and the amount of time students have had to complete it;
- The timing, duration and reason for the student's absence from school.

Except in cases of extenuating circumstances, retrospective requests for extensions will not be considered.

Taking into account the above, no late work will be accepted. If assessments are missed or performance is impaired due to factors beyond the student's control then one reassessment may occur if possible.

If a student is aware that he will be absent from school on the due date of an assessment, the work must be handed in before that day.

If a student is to be absent from school on the day of an assessment task because of a scheduled school activity, the student should communicate this in advance with the relevant teacher so that appropriate arrangements can be made.

Should a student be absent from school on the due date of an assessment through illness or injury, arrangements must be made to have the assessment work **handed in at the school's main office by 10.00 a.m.** A medical certificate is also required.

If unable to hand work in as stated above, a medical certificate must be presented upon the student's return to school.

All student assessment scripts will be kept at school until they are no longer required by the school or NZQA for moderation purposes.

FURTHER ASSESSMENT OPPORTUNITIES

There will be no further assessment opportunities offered for internal Achievement Standards in Chemistry.

RE-SUBMISSION

Re-submission opportunities will be provided in some Achievement Standards that require work over an extended period.

Re-submission will only be available in cases where a minor deficiency has prevented a student from reaching the required standard.

All final decisions on re-submission will be made by the teacher under the direction of the HOD on a case-by-case basis.

APPEALS

Students have the right to appeal assessment outcomes. This needs to be discussed with the class teacher in the first instance. Students may appeal any assessment-related decision, such as decisions relating to results, missed and late assessments and breaches of the rules.

An application for formal appeal must be made within five school days of the assessment being returned. Appeals must be made by parents on the official application form obtainable from Mr. Atkin.

The NCEA Co-coordinator or the Principal's Nominee will make the final decision on any appeal.

EXAMINATIONS AND OTHER ASSESSMENTS

These will occur as they are deemed appropriate. Their purpose is to:

- obtain summative information on a student's ability;
- provide a formative assessment / practice for external Achievement Standards;
- provide opportunities for summative reassessment of internally assessed Achievement / Unit Standards where possible;
- provide information (which may be comparative) on learning outcomes for students;
- Gather appropriate information for reporting purposes.

Results will be recorded as a grade:

NA or N	Standard not achieved
A	Standard achieved
M	Standard achieved with merit
E	Standard achieved with excellence

Reporting Not Achieved results: Where a student has presented work or evidence for assessment OR has been given an adequate opportunity to achieve the standard (consistent with school internal assessment procedures), the outcome of that assessment must be reported to NZQA as N, A, M or E.

SPECIAL ASSESSMENT CONDITIONS

1. Candidates with a permanent or long-term:
   - medical, physical or sensory condition and/or
   - specific learning disability that directly impacts on their ability to be assessed fairly in assessments for National Qualifications may apply for entitlement to Special Assessment Conditions.

2. NZQA grants entitlement to Special Assessment Conditions so that approved candidates may be fairly assessed and have access to assessment for National Qualifications. Special Assessment Conditions are approved so that entitled candidates can demonstrate their knowledge, skills and understanding, without providing unfair advantage over other candidates.

3. Special assessment conditions will only be granted for candidates with a specific learning disability who can access the curriculum at the appropriate level of assessment.

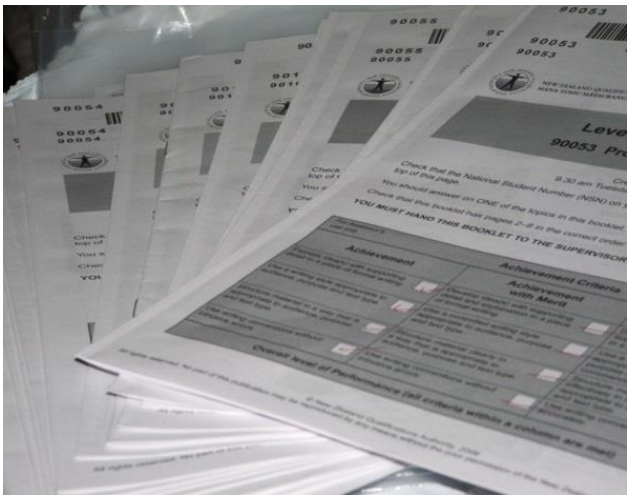
4. Candidates identified and funded as speakers of English as a Second Language are not entitled to Special Assessment Conditions even in conjunction with a specific learning disability.

Through testing and examinations the school makes every effort to identify candidates who might be eligible for Special Assessment Conditions. However, if a student is new to the school and an opportunity for testing has not been available, then applications can be made early in Term 1 via Mrs Rankin, Head of Learning Support.

Storage and Confidentiality of Student Work

Student assessment material will be stored by the Head of Chemistry, until such time as it is no longer required for moderation purposes. Student work and grades are strictly confidential and will only be shared with other students when permission is given by the owner of the work. A student may ask to see their own work at any time, but may not remove it or make copies of it.

For more information, see PNBHS NCEA POLICY & PROCEDURES. A Guide for Students & Parents found on Stratus.



External Assessment:

June:
Massey University
paper final examination
November:
NCEA Level 3 Chemistry External Examination
(AS 3.4, 3.5, 3.6)

Reference: www.dundeechest.com

NCEA Achievement Standards

For all Achievement Standards the following terms, Criteria and Quality Assurance conditions apply

Terms

- *Describe* involves identifying, naming, drawing, giving characteristics of, giving an account of, and/or defining.
- *Explain and apply* involves describing as well as giving reasons for, making links between chemical concepts and/or observations.
- *Discuss* involves showing understanding by analysing, interpreting, justifying, relating, evaluating, and/or comparing and contrasting.

Achievement Criteria

Externally Assessed Standards

The Achievement Criteria in each Achievement Standard is set the same.

Achievement	Achievement with Merit	Achievement with Excellence
• Describe (Demonstrate understanding)	• Explain and apply (Demonstrate in-depth understanding)	• Discuss, justify, compare and contrast (Demonstrate comprehensive understanding)

Quality Assurance

1 Providers and Industry Training Organisations must be accredited by the Qualifications Authority before they can register credits from assessment against achievement standards.

2 Accredited providers and Industry Training Organisations assessing against achievement standards must engage with the moderation system that applies to those achievement standards. Accreditation and Moderation Action Plan (AMAP)

Achievement Standards

Achievement Standards can be found on the NZQA website:

http://www.nzqa.govt.nz/ncea/assessment/search.do?query=Chemistry&view=achievements&level=03

Below are the explanatory notes associated to each Achievement Standard for the course this year.

Internally Assessed Standards

Subject Reference	Chemistry 3.1 (91387 version 2)				
Title	Carry out an investigation in chemistry involving quantitative analysis				
Level	3	**Credits**	4	**Assessment**	Internal
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 carrying out an investigation in chemistry involving quantitative analysis.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Carry out an investigation in chemistry involving quantitative analysis.	• Carry out an in-depth investigation in chemistry involving quantitative analysis.	• Carry out a comprehensive investigation in chemistry involving quantitative analysis.

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

Procedures outlined in *Safety and Science*: *a Guidance Manual for New Zealand Schools,* Learning Media, Ministry of Education, 2000, should be followed.

2 *Carry out an investigation in chemistry* involves:
- exploring a possible trend or pattern in the quantity of substance in a sample
- developing and carrying out a procedure to collect data about a possible trend or pattern in the quantity of a substance
- collecting and recording a sufficient quantity of data to enable a conclusion to be reached

- processing of the data to reach a conclusion
- presenting a report that contains:
  - a statement of the purpose of the investigation
  - a description of the procedure that includes preparation of samples and the analytical technique used
  - a summary of the collected and processed data
  - a conclusion based on the processed data.

Carry out an in-depth investigation in chemistry involves:

- collection of quality data which includes standardising the standard solution(s) and control of significant variables
- accurate processing of the data to reach a valid conclusion
- providing evidence of the mathematical steps used to process the experimental data
- presenting a report that contains:
  - a description of the procedure in sufficient detail for the investigation to be duplicated
  - a conclusion that links the processed data to the purpose of the investigation
  - an explanation of how the procedure used contributed to the collection of quality data.

Carry out a comprehensive investigation in chemistry involves:

- accurate processing of the data using appropriate significant figures and units
- presenting a report that shows evidence of:
  - justifying the steps used in the procedure in relation to the reaction(s) occurring and to the nature of the samples being analysed
  - a comprehensive evaluation of the investigation that includes a selection from:
    - evaluation of the reliability of the data by considering the procedure used and possible sources of error
    - justification of how the processed data supports the conclusion(s)
    - linking the conclusion(s) to chemical principles and/or real life applications.

3 A logbook needs to be kept throughout the investigation. The logbook contains details of the development of the purpose, procedure, raw data, and calculations.

4 Instructions may be provided for an analytical technique that may be used in a school laboratory, or equivalent.

5 The investigation is based on an analytical technique such as titration (acid-base or redox) or colorimetry.

6 To enable a conclusion to be reached titre data values of at least 5 mL are required or for colorimetry the range of the standard curve must be appropriate.

7 Conditions of Assessment related to this achievement standard can be found at www.tki.org.nz/e/community/ncea/conditions-assessment.php.

Subject Reference	Chemistry 3.3 (91389 version 2: optional – done in own time)				
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 2019	**Date version published**	17 November 2016		

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

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Demonstrate understanding of chemical processes in the world around us.	• Demonstrate in-depth understanding of chemical processes in the world around us.	• Demonstrate comprehensive understanding of chemical processes in the world around us.

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 Nature of Science achievement objectives:
Understand that scientists have an obligation to connect their new ideas to current and historical scientific knowledge.
Develop and carry out investigations that extend their science knowledge, including developing their understanding of the relationship between investigations and scientific theories and models.
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.
and the Material World achievement objective:
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.

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.

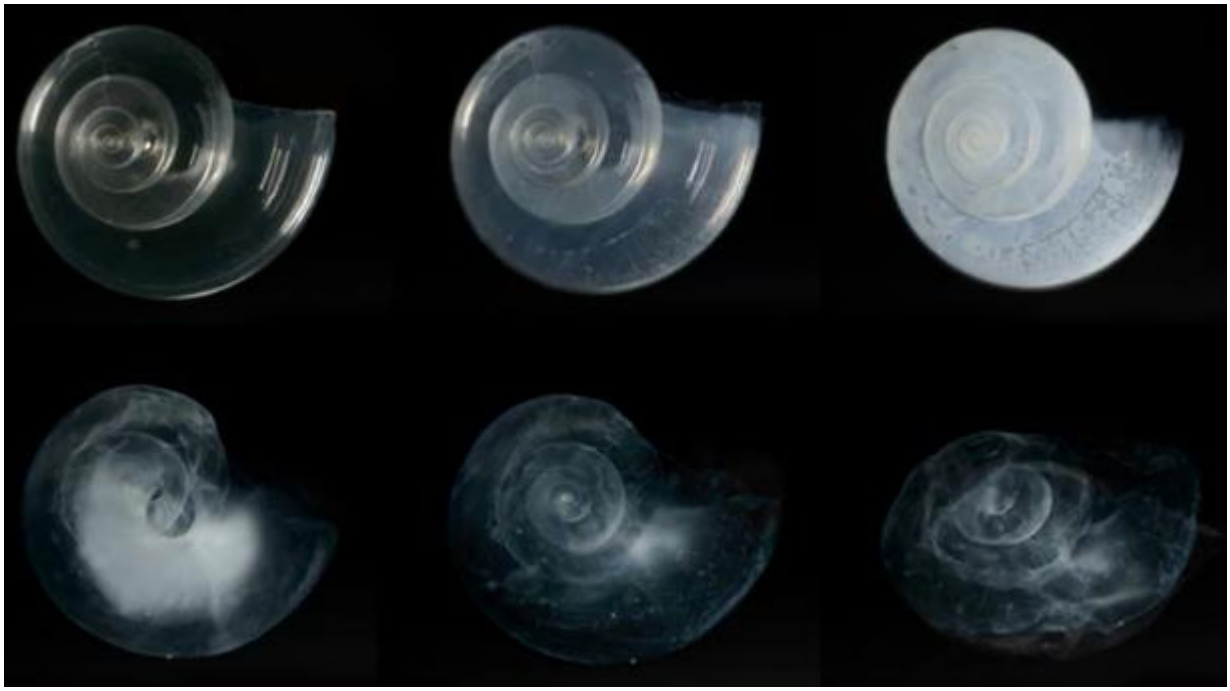
2 *Demonstrate understanding* involves processing and interpreting given information to identify, describe, and give an account of chemical processes occurring in the natural world or developed in response to an issue or need. The account given must be supported by the use of chemistry vocabulary, symbols,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

3 *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.

4 Conditions of Assessment related to this achievement standard can be found at www.tki.org.nz/e/community/ncea/conditions-assessment.php.



www.climatechangenews.com/2017/05/15/ocean-acidification-global-warmings-forgotten-crisis/

Massey University Course

Below is the suggested study schedule for the Massey course taken from 'Stream' and comments about it.

The schedule below, which follows the internal timetable is only a suggested one. You may prefer to work out your own schedule, one that suits your personal requirements. The main point is to work to some schedule so that you don't fall behind.

Please note: chemistry is not a subject that is neatly divided into small unrelated chunks, do not try learn it as such. Each section either lays the groundwork for topics to come or builds upon material already covered, and, in many cases does both. Do not let the table below fool you into thinking you can master one section then ignore it.

Week	Unit	Lecture Material	Reading & Resources	Assessment
1	**1: Structure of Organic Molecules**	Introduction to chemical formulae & structures	Unit 1 Parts 1 – 3 *Unit 1 lectures; Unit 1 ShowMes; Unit 1 videos*	
		Functional groups & nomenclature		
		Bonding & Shape		
2		Bonds & resonance	Unit 1 Parts 4 – 6 *Unit 1 lectures; Unit 1 ShowMes; Unit 1 videos*	
		Intermolecular forces & solubility		
		Reactions & reagents		
3		Shape & conformation	Unit 1 Parts 7 – 9 *Unit 1 lectures; Unit 1 ShowMes; Unit 1 videos*	Mastery Test 1 Semester Test 1
		Shape & stereochemistry		
		NMR spectroscopy		
4		IR & mass spectrometry	Unit 1 Part 10 & Unit 2 Parts 1 – 2 *Unit 2 ShowMes; Unit 2 Videos; Unit 2 online tutorials*	
	2: Organic Reactions	Acid-bases		
		Substitution Reactions		
5		Reactions of alkenes & alkynes	Unit 2 Parts 3 – 5 *Unit 2 ShowMes; Unit 2 Videos; Unit 2 online tutorials*	
		Electrophilic substitution		
		Oxidation and reduction		
6		Nucleophilic addition to carbonyls	Unit 2 Parts 6 – 7 & Unit 3 Part 1 *Unit 2 ShowMes; Unit 2 Videos; Unit 2 online tutorials*	Mastery Test 2
		Reactions of carboxylic acids & derivatives		
	3: Physical Chemistry	Chemical equilibrium & chemical reactions		
7		Chemical equilibrium & chemical reactions	Unit 3 Parts 2 – 7 *Unit 3 ShowMes; Unit 3 Videos; Maths First (help*	Mastery Test 3
		Acid/base chemistry, pH, pKa,		

		titrations, buffers	*with maths)*	
		Acid/base chemistry, pH, pKa, titrations, buffers		
8		Acid/base chemistry, pH, pKa, titrations, buffers	Unit 3 Parts 8 – 10 *Unit 3 ShowMes; Unit 3 Videos; Maths First (help with maths)*	Semester Test 2
		Rates of reaction, orders of reaction, mechanisms		
		Rates of reaction, orders of reaction, mechanisms		
9		Rates of reaction, orders of reaction, mechanisms	Unit 3 Part 10 & Unit 4 Part 1 *Unit 3 ShowMes; Unit 3 Videos; Maths First (help with maths)*	
	4: Applications of Organic Chemistry	Applications of organic synthesis		
		Applications of organic synthesis		
10		Polymer chemistry	Unit 4 Parts 2 – 3 *Unit 4 ShowMes; Unit 4 Videos*	Mastery Test 4
		Carbohydrate chemistry		
		Carbohydrate chemistry		
11		Amino acids, peptides, proteins & enzymes	Unit 4 Part 4 *Unit 4 ShowMes; Unit 4 Videos*	
		Amino acids, peptides, proteins & enzymes		
		Amino acids, peptides, proteins & enzymes		
12		Triglycerides & soap	Unit 4 Parts 5 – 6 *Unit 4 ShowMes; Unit 4 Videos*	Mastery Test 5 (study break) Final Exam details on Massey website **All Mastery Tests must be finished by Final Exam.**
		Nucleic acids & DNA		
		Revision/spare for statutory holidays		

Contacts for Massey Paper

If you are enrolled in the Massey course and are unable to attend a lab or you have further questions about the course, it is up to you to contact the lecturer directly.

A/Prof Gareth Rowlands
Palmerston North Paper Coordinator
Office: ScA4.12
Email: g.j.rowlands@massey.ac.nz

Dr Vyacheslav Filichev
Office: ScA 4.09
Email: v.filichev@massey.ac.nz

Nessha Wise
Office: ScA 2.18
Email: n.m.wise@massey.ac.nz

Assessments

Below is a summary of the assessment for 123.101 (semester 1 offering):

Assessment	Date	Weighting	Notes
Semester Test 1	Week 3	10%	covers Unit 1 parts 1- 6
Semester Test 2	Week 8	15%	covers **all** of Units 1 & 2
Laboratory component	Weekly	20%	5% from each lab tests (expt 6 & 10); 10% remaining 9 expts.
Mastery Test	day of final exam	10%	Suggested completion dates in the calendar and study schedule. All Mastery Tests must be completed by day of final exam.
Final Exam	see Massey website	45%	

Dates provided at start of course.

Date of the Final Exam is not determined by the teaching staff. It can be found on the Massey website.

Advanced Chemistry Timeline 2019

Term 1: 28th Jan – 12th April

Week 1	2	3	4	5	6	7	8	9	10	11
Massey Paper		CAMP	Massey paper							

Term 2: 29th April – 5th July

Week 1	2	3	4	5	6	7	8	9	10
Massey							Massey finishes	3.1 internal	
3.2 Spectroscopy internal (3)				3.4 Particles and thermochemistry external (5)					

Term 3: 22nd July – 27th Sept

Week 1	2	3	4	5	6	7	8	9	10
3.1	3.1	3.1	Sci fair	Scholarship Qs			Schol Qs/exams	exams	revision

NOTE: Optional Internal 3.3 is given as a holiday exercise at the end of term 2. Due date is the end of the first week back.

Term 4: 14thOct – 5thDec

Week 1	2	3	4	5	6	7	8
revision	revision	revision	NCEA examinations				Prize-giving



Specific Learning Outcomes

Below is the list of learning outcomes for each Achievement Standards. As you complete each item, tick the box.

You should be able to……

3.1 Carry out an investigation in chemistry involving quantitative analysis (91387)

• Choose an aspect of everyday life to investigate that involves analysing a pattern or trend	
• Develop a purpose that is expressed clearly as an aim or hypothesis	
• Describe procedures including the preparation of samples and analytical techniques used	
• Collect and record at least 5 data points for the independent variable	
• Accurately process data and use appropriate significant figures	
• Elaborate on reasons for any modifications to procedures	
• Justify how the processed data supports the conclusions	
• Evaluate the reliability of data by considering the procedure used and sources of error. This includes the mention of standardisation and repeating a test point	
• Outline how significant variables were controlled	
• Link the conclusion to chemical principles and or real life applications. This involves explaining the chemistry and linking any colour changes to species and using/explaining associated chemical equations	
• Keep a logbook of all findings and experimental work.	
• Write a report that accurately explains your findings and relevance to real life with reference to literature.	

3.3 Demonstrate understanding of chemical processes in the world around us (91389)

• Collect information about the chemical process	
• Process and interpret information collected and record notes	
• Describe the comprehensively the consequences of the chemical processes for the environment and/or the people involved	
• Consider political, economic and future aspects of the chemical process(es) and discuss these from more than one view-point	
• Link findings to research and/or technologies in other scientific fields e.g. ecology, earth sciences etc	
• Use chemistry vocabulary extensively to describe the chemical process(es) integrating and explaining chemical equations where particularly possible	
• Evaluate the discovery with respect to its use in society. Consider any challenges the new technology might present/introduce	
• Compare and contrast the process(es) used to meet the needs, resolve issues and/or develop new technologies for the environment or people	

Massey University – 23.101 Learning Outcomes

Unit One	
• Recognise different ways chemists represent compounds	
• Interpret ball and stick and space-filling models of molecules	
• Write and interpret molecular, structural, condensed structural and skeletal formulae for chemical compounds	
• To write and interpret IUPAC names for small organic compounds containing one or two functional groups	
• Identify some common functional groups in organic compounds	
• Recognise and draw structural isomers of compounds with a given molecular formula	
• Describe single, double and triple bonds in terms in terms or orbital overlap and the formation of σ and π bonds	
• Recognise atoms in molecules which have lone pairs of electrons	
• Describe the relationship between bond strength, bond length and bond multiplicity	
• Describe the difference between covalent and ionic bonding	
• Define electronegativity and use the concept to identify polar and nonpolar bonds	
• Know the geometry of regions with single, double and triple bonds	
• Determine the geometry of simple molecules from the structural formula	
• Understand how bond polarisation gives bond dipoles and molecular dipoles	
• Know about the forces between polar and nonpolar molecules and ions (intermolecular forces).	
• Explain the difference in strength of dispersion forces, dipole-dipole forces, hydrogen-bonding, and ion-dipole interactions	
• Recognise polar molecules and electron –withdrawing and electron-donating inductive groups	
• Understand hydrogen bonding and how it affects the properties of organic molecules	
• Understand the forces (London) between nonpolar molecules and how they affect the properties of organic molecules	
• Describe the process of solvation and recognise hydrophobic and hydrophilic parts of molecules	
• Write and balance chemical equations for simple organic reactions	
• Identify addition, substitution and elimination reactions	
• Identify the chemical bonds that are made and broken in simple organic reactions	
• Recognise electrophilic and nucleophilic centres in molecules	
• Interpret reaction profiles in terms of the order of bond making and bond breaking processes.	

Unit Two – Organic Reactions	
• Write equations for the acid-base equilibria for organic acids and bases.	
• Use curly arrows to illustrate the movement of electrons in proton (H^+) transfer reactions	
• Describe the role of the solvent in acid-base equilibria	
• Interpret reaction profiles for acid-base reactions	
• Describe factors that influence the relative acidities/basicities of organic acids, alcohols, phenols, alkynes and amines	
• Explain the mechanisms of SN1 and SN2 nucleophilic aliphatic substitution reactions in terms of molecular interactions	
• Describe factors that influence the mechanism of nucleophilic aliphatic substitution reactions	
• Write equations to describe nucleophilic substitution reactions involving alkyl halides, alcohols, ethers, amines, thiols and nitriles	
• Describe the mechanism of electrophilic addition to carbon-carbon bonds using mechanistic equations with curly arrows and reaction profiles	
• Predict the product of electrophilic addition reactions involving unsymmetrical alkenes, and explain the basis of Markovnikov's rule	
• Use a range of addition and elimination reactions involving alkenes and alkynes	
• Write equations for the halogenation, nitration, alkylation and acylation of aromatic compounds	
• Describe the process of electrophilic aromatic substitution I terms of bond making and bond breaking events	
• Compare the mechanism of electrophilic aromatic substitution with electrophilic addition to alkenes	
• Name substituted benzenes	
• Analyse appropriate reactions in terms of oxidation or reduction processes taking place	
• Write equations for, and predict the products of, reactions involving the oxidation of alcohols and aldehydes	
• Give the products of catalytic hydrogenation reactions (reductions) of multiple bonds	
• Describe the steps in the reduction of carbonyl groups by metal hydrides and nucleophilic acyl addition	
• Write equations for, and predict the products of, reactions involving nucleophilic addition to aldehydes and ketones	
• Write equations for, and predict the products of, reactions involving addition of cyanide to aldehydes and ketones	

• Write equations for, and predict the reactants for, reactions involving formation of hemiacetals and acetals	
• Write equations for and predict the reactants for reactions involving formation of imines	
• Write equations for the interconversion of carboxylic acids and their derivatives including acid chlorides, esters and amides	
• Describe the relative reactivities of carboxylic acids and their derivatives	
• Discuss the influence of factors on the position of equilibria in appropriate reactions such as esterification	

Unit Three – Physical Properties	
• To know what is meant by chemical equilibrium	
• To be able to write down the expression for the equilibrium constant	
• To be able to deduce the position of a reaction at equilibrium for the value of the equilibrium constant	
• To be able to predict the effect of changing some factors on an equilibrium reaction	
• To understand how chemists can manipulate equilibrium reaction conditions to maximise the yield	
• To be able to calculate the equilibrium constant for equilibrium concentrations	
• To be able to calculate equilibrium concentrations for initial concentrations given the equilibrium constant	
• To understand the behaviour of acids, bases and buffers	
• To understand the equilibria involved in aqueous solutions of acids, bases and buffers	
• To be able to calculate pH and concentrations of species for acids, bases and buffers.	
• To understand titration curves and be able to determine the concentration of an acid or base from titration results	
• To know the definition of acid and base in terms of proton transfer	
• To know the difference between strong and weak acids and strong and weak bases	
• To know what is meant by a conjugate acid-base pair	
• To be able to define the acid dissociation constant, K_a	
• To be able to relate the strength of an acid to that if its conjugate base	
• To know the definition of pH, pOH, pK_b and pK_a, and how to calculate each	
• To be able to calculate the pH of a solution of a weak or strong acid or base	
• To understand the behaviour of acids, bases and buffers	
• To understand the equilibria involved in aqueous solutions of acids, bases and	

buffers	
• To be able to calculate pH and concentrations of species for acids, bases and buffers.	
• To understand titration curves and be able to determine the concentration of an acid or base from titration results.	
• To be able to define what is meant by a buffer, and to explain qualitatively how it acts to resist changes in pH	
• To know how to derive and use the Henderson-Hasselbalch equation for calculating the pH of buffers	
• To be able to explain the effective buffering range for a buffer	
• To know the general shape of acid-base pH titration curves	
• To be able to explain in the titration of a weak acid why the pH of the solution at the half-neutralisation point equals the pK_a	
• To be able to calculate the pH at each stage of an acid-base titration	
• To be able to describe how acid-base indicators work	
• To know how to choose a suitable indicator for an acid-base titration	
• To know how to use the results from an acid-base titration to determine the concentration of an acid or base	
• To know the role of the bicarbonate buffer in maintaining the blood plasma pH	
• To know the role of the phosphate buffer in the body	
• To know the definition of a Lewis acid and a Lewis base	
• To be able to explain what is meant by the rate of a reaction	
• Given a chemical reaction, to be able to write down an expression for the rate of the reaction in terms of any reactant or product	
• To know what is meant by a rate law	
• To know what is meant by the order of a reaction	
• To understand that the order of a reaction must be determined from an experimental rate study	
• To know that the order of a chemical reaction may be different from the stoichiometry of the reaction	
• To be able to predict the effect on the rate of reaction of doubling the concentration of a reactant for zero, first, second and third order reactions	
• To know the units of the rate constant for a zero first, second order reaction when concentrations are measured in $molL^{-1}$ and time in seconds	
• To know that the half-life of a first order reaction ($t_{0.5}$) equals (ln 2)/k	
• Given the rate constant for a first order reaction to be able to calculate the half-life	
• To be able to state what is meant by a reaction mechanism	
• To know what is meant by a unimolecular or bimolecular reaction	
• To understand what is meant by a rate-determining step in a reaction mechanism	

• To be able to derive the rate law for a reaction mechanism in which either the first step is slow, or , the second step is slow, while the first step involves a rapid equilibrium	
• To know how the rate constant for a reaction varies with temperature (the Arrhenius equation).	
• To know what is meant by the activation energy of a reaction	
• To be able to sketch a potential energy versus progress of reaction plot and indicate what is meant by the activation on the diagram	
• To be able to explain how the activation energy can be seen as the minimum kinetic energy required for reaction	
• To be able to explain why the rate of a reaction increases with temperature	
• To know what is meant by the term catalyst and be able to explain how the catalyst achieves its effect by lowering the activation energy for a reaction	

Unit Four - Applications	
• Analyse organic syntheses in terms of the functional group transformations taking place, and where appropriate the mechanisms of reaction steps	
• Choose suitable reagents to perform any of the steps in a synthesis that use reactions you are already familiar with	
• Be able to determine the intermediate product in a two-step retrosynthesis	
• Write a synthesis from a retrosynthesis	
• Plan short synthetic organic reaction sequences using reactions you are already familiar with	
• Identify the monomers used, or polymer formed, in a polymerisation reaction	
• Understand the reaction in which addition polymers are formed via radical or electrophilic addition mechanisms	
• Describe the reactions forming polyester and polyamide condensation polymers	
• Define carbohydrates, monosaccharides, disaccharides, aldoses and ketoses, epimers and anomers	
• Recognise monosaccharides that are enantiomers or diastereomers	
• Write reactions that illustrate the formation of hemiacetal rings in monosaccharides	
• Write reactions that illustrate the formation of glycosides	
• Identify whether monosaccharides or disaccharides are reducing sugars	
• Identify the different arrangement of glucose units that make up starch, cellulose and glycogen	
• Learn the general formula for the dipolar form of an amino acid and describe the different types of amino acid side chain	
• Describe the shape of a titration curve of an amino acid and identify the isoelectric point	

• Describe the structure of a peptide identifying the peptide bond, and the N-terminus and the C-terminus	
• Describe the interactions which determine the structure of a protein and identify the primary, secondary, tertiary and quaternary levels of structure	
• Explain how the properties of enzymes make the catalysis of important biological reactions possible	
• Explain the nature of a triglyceride in terms of glycerol and fatty acids	
• Distinguish between saturated and unsaturated fatty acids	
• Give the saponification reaction for a triglyceride	
• Describe the molecular basis of detergent action in terms of micelles	
• Contrast the structure and properties of synthetic detergents with soaps	
• Identify the component group in nucleic acids	
• Describe the structure of strands of nucleotides and the formation of the DNA double helix	

My Assessment Progress

Record all test and examination results here for your own reference

Achievement Standard	Credits	Grades
		Internal Assessments Summative Assessment
3.1	**4**	
3.3 (Optional)	**3**	
		PNBHS Senior examination result Formative Assessment
Scholarship paper		

Massey University

		Massey University Assessments Summative Assessment
Mastery	**1**	
Mastery	**2**	
Mastery **Mastery** **Mastery** **Semester test** **Semester test** **Final exam** **Lab grade**	**3** **4** **5** **1** **2**	

* Provisional Credits only.

Grades sent to NZQA reflect the best achievement of a student in the assessments of the given Standard.

Grades are: N= Not Achieved A= Achieved M= Achieved with Merit
E= Achieved with Excellence

References: www.odt.co.nz

A Copy of this booklet can be found on the Stratus Chemistry Page