T A S M A N I A N

Q U A L I F I C A T I O N S

A U T H O R I T Y

Chemistry

CHM315109, TQA Level 3, Size Value = 15

THE COURSE DOCUMENT

This document contains the following sections:

LEARNING STATEMENT

Knowledge and understanding of science, scientific literacy and scientific methods are necessary for students to develop the skills to resolve questions about their natural and constructed world.

The purpose of science education is to develop scientific literacy, which is a high priority for all citizens, helping them: to be interested in, and understand, the world around them; to engage in discourse about science; to be sceptical and questioning of claims made by others about scientific matters; to be able to identify questions and draw evidence-based conclusions; and to make informed decisions about the environment, about their own health and well-being and about the role and impact of science on society.

Period of Accreditation: 1/1/2009 – 31/12/2013
Date of Publishing: 28 October 2011

Scientifically literate students can therefore describe, explain and predict natural phenomena and can discuss the validity of their conclusions. This enables them to identify and understand the scientific and technological aspects underlying national and local issues and to form opinions which are reasoned and informed. It also leads to the proper evaluation of the quality of scientific information on the basis of source and on the methods used to generate it. The study of science raises awareness of the central role that science and technology can play both in encouraging life-long learning and in enabling a student to pursue a career path in science.

COURSE SIZE AND COMPLEXITY

This course has been assessed as having a complexity level of TQA level 3.

At TQA level 3, the student is expected to acquire a combination of theoretical and/or technical and factual knowledge and skills and use judgment when varying procedures to deal with unusual or unexpected aspects that may arise. Some skills in organising self and others are expected. TQA level 3 is a standard suitable to prepare students for further study at the tertiary level. It is an approximate match to Tasmanian Certificate of Education (TCE) level 5 courses and VET competencies at this level are often those characteristic of an AQF Certificate III.

The TQA level 3 course has a size value of 15 (150 hours design-time).

RESOURCES

This course requires a suitably equipped laboratory and resources to conduct experiments safely and effectively. Students need to be able to access a wide range of reliable sources of information about the uses and applications of science within the wider community.

ACCESS

Students are required to be able to work responsibly and safely in practical situations as using potentially dangerous materials and equipment are central to this course.

PATHWAYS

Study of this course has been identified as highly advantageous for the future study of Agricultural Science, Applied Science, Aquaculture, Biochemistry, Biotechnology, Botany, Chemistry, Dentistry, Dietetics, Engineering, Food Technology, Forensic Science, Geology, Health Science, Nursing, Marine Science, Medicine, Pharmacy, Physiotherapy, Psychology, Sports Science, Veterinary Science, Viticulture, Oenology and Zoology.

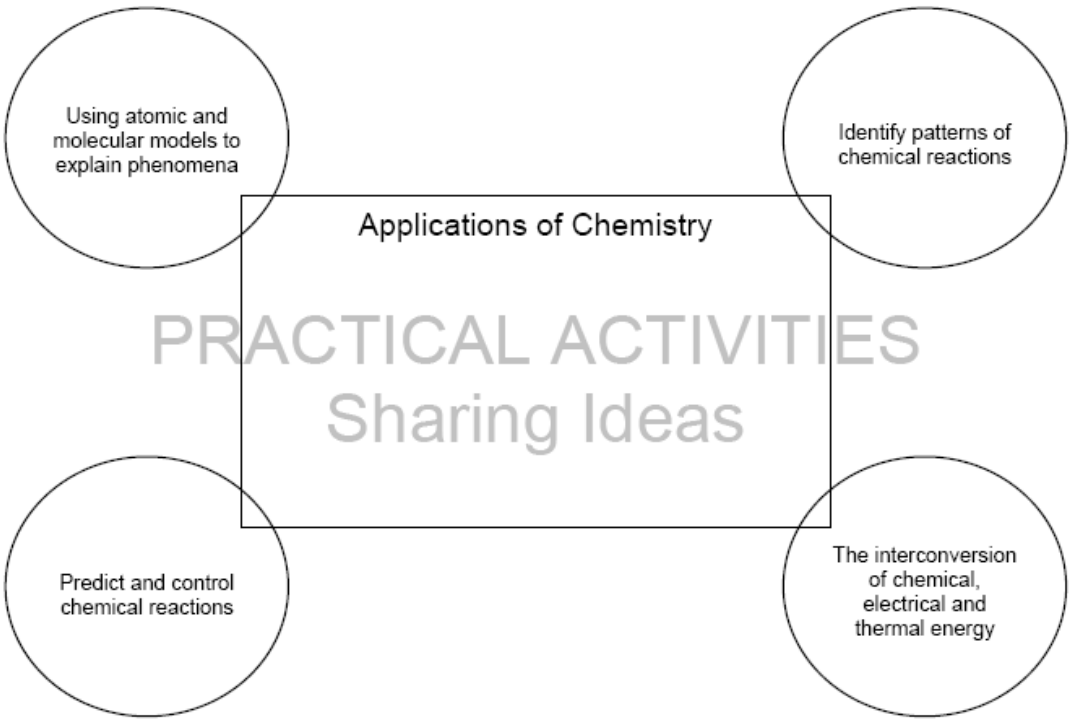
COURSE OUTLINE

LEARNING OUTCOMES

Students completing this course will:

- become self-directed, able to plan their study and persevere to complete tasks and meet deadlines
- develop cooperative skills
- develop practical skills in the use of techniques and equipment
- develop an understanding of scientific method
- communicate chemistry information following accepted conventions
- develop discriminating research skills
- develop an understanding of the role and impact of chemistry on society
- apply their understanding to problem solving
- analyse and interpret data to draw conclusions
- develop an understanding of the important basic concepts of electrochemistry
- develop an understanding of the important basic concepts of thermochemistry, kinetics and equilibrium
- develop an understanding of the important basic concepts of properties and reaction of organic and inorganic matter
- develop an understanding of the application of logical quantitative analysis within chemistry.

SCHEMATIC OVERVIEW



SUMMARY

This course includes the following content areas:

ELECTROCHEMISTRY

- Redox reactions
- Electrochemical cells
- Electrolysis
- Corrosion: the chemical process and prevention

CHEMICAL STOICHIOMETRY

- Limiting reagents
- Analysis by mass
- Analysis of solutions
- Quantitative treatment of gas equations

ORGANIC CHEMISTRY

- Polymers
- Introduction to simple aromatics
- Organic functional groups
- Alkyl halides, alcohols, aldehydes, ketones, carboxylic acids, esters

ELECTRONIC STRUCTURE AND THE PERIODIC TABLE

- Development of the modern periodic table
- Electronic structure
- Trends

GASES

- Physical properties of gases and the kinetic theory
- Gas laws and the ideal gas equation

ENERGY AND CHEMICAL CHANGE

- Thermal energy from chemical reactions
- Heat of reactions

RATES OF REACTION

- Factors affecting the rate of reactions
- Collision theory
- Activation energy
- Catalysts

CHEMICAL EQUILIBRIUM

- Factors affecting yields of reactions
- Calculations associated with equilibrium

COURSE CONTENT

REDOX

What is a redox reaction?	• define a redox reaction
Recognising redox reactions	• use clues such as element ←→ compound
Assigning oxidation states	• assign oxidation states for hydrogen and oxygen in compounds that include metal hydrides and peroxides • calculate oxidation states of elements in molecules, molecular ions and compounds • identify substances that are undergoing oxidation and reduction in a redox reaction • use the electrochemical series to identify oxidisers and reducers and to predict whether a redox reaction will occur spontaneously • identify oxidisers and reducers by the oxidation states of the atoms that they contain, e.g. IO_3^-, I_2, I^-
Balancing redox reactions	• balance redox reaction in the presence of hydrogen ions • construct half equations for oxidation and reduction using $H_2O_{(l)}$, $H^+_{(aq)}$ and electrons • write overall equations by adding half-equations

ELECTROCHEMICAL CELLS

Galvanic cells	• understand terms associated with electrochemical cells including: electrodes, anode, cathode, electrolyte, salt bridge, porous barrier, anions, cations, internal circuit and external circuit • sketch labelled diagrams of galvanic cells (cells involving two metals in solutions of their ions) • predict the direction of movement of ions in the internal circuit and electrons in the external circuit • explain how an electrochemical cell can produce electrical energy
Salt bridge/porous barrier	• explain the role of the salt bridge or porous barrier in maintaining electroneutrality
Shorthand representation	• use chemical shorthand to represent a variety of electrochemical cells including cells composed of inert electrodes • adhere to conventions of writing anode on the left and cathode on the right • sketch a cell diagram represented by chemical shorthand
Non-galvanic cells	• sketch and construct cells not composed of metals and solutions of their ions including cells with inert electrodes and electrolytes containing species with different oxidation states • identify the chemicals and materials required to construct a cell
The Electrochemical Series	• explain how the electrochemical series was devised • use the electrochemical series to predict which electrode is the anode or cathode of an electrochemical cell
E^o values	• calculate the EMF of a cell under standard conditions, E^o

ELECTROLYSIS

Electrolysis of molten salts	• predict the products of electrolysis of molten salts
Electrolysis of aqueous solutions	• predict the products of electrolysis of aqueous solutions using inert electrodes or reactive electrodes • recognise that anions containing elements in their maximum oxidation states (CO_3^{2-}, NO_3^-, SO_4^{2-}, HSO_4^-, PO_4^{3-}, HPO_4^{2-}, $H_2PO_4^-$) cannot be oxidised further
Competing reactions	• understand the possibility of competing reactions when the concentrations of species in the electrolyte are non-standard • use the electrochemical series to predict the products of electrolysis and understand the limitations of these predictions
Electrorefining and electroplating	• be familiar with the processes of electrorefining and electroplating
Faraday's Laws of electrolysis	• perform calculations to find the mass of products, the current or the time of electrolysis using Faraday's Laws
What is corrosion?	• understand that corrosion involves the oxidation of metals by substances in the environment
Physical properties of rust	• understand that steel has metallic bonding and that rust has ionic bonding • contrast the physical properties of steel and rust • recognise that the volume occupied by 1 mole of rust is much greater that the same amount of steel
The cost of rusting to society	• understand that the replacement of steel parts such as car mufflers and the treatment of structures to delay corrosion is a great cost to society
Rusting's electrochemical nature	• describe the electrochemical nature of rusting and predict the likely sites of oxidation and reduction • understand that stresses increase the likelihood of anode formation • understand that cathodes tend to occur where the concentration of O_2 is highest • understand that a variation in the concentration of O_2 can lead to the formation of an electrochemical cell • understand the role of dissolved ions in accelerating corrosion • predict which metal will be the anode and which will be the cathode when two metals are in contact with an electrolyte

Corrosion prevention	• describe ways in which corrosion can be prevented by excluding the environment:
	  • painting
	  • lubrication
	  • metal coatings (noble and sacrificial)
	  • polymer coatings
	• describe ways in which the corrosion of steel can be prevented using cathodic protection:
	  • explain how a sacrificial anode works and identify situation where it could be used
	  • explain how an applied EMF can be used to protect a steel structure

CHEMICAL STOICHIOMETRY

Mass calculations	• calculate the masses of a reactant and/or product when one of the reactants is identified as the limiting reagent • identify the limiting reagent when the masses of more than one reactant are known
Gravimetric analysis	• precipitation, % purity, water of crystallisation
Mass-volume calculations	• describe the properties of primary standard substances • prepare standard solutions • perform dilutions using analytical glassware and calculate the concentrations of the resulting solutions
Volumetric analysis	• perform acid-base and redox titrations • calculate the concentrations of unknown solutions by using the data collected from volumetric analysis

ORGANIC CHEMISTRY

Benzene	• structure, substitution and addition reactions

Addition and substitution reactions	• compare the reactions of alkanes, alkenes and aromatics hydrocarbons with halogens:
	  • understand that alkanes and aromatic compounds undergo substitution reactions
	  • write combustion reactions for hydrocarbons reacting with an excess of oxygen and reactions where there is insufficient oxygen
	  • understand that alkenes and alkynes undergo addition reactions
	  • understand that alkenes form addition polymers
	• write balanced equations for the reactions of alkenes and alkynes with asymmetric molecules, including: hydrogen, halides and steam, and name the products
	• recognise that more than one isomer is possible when an asymmetric molecule reacts with an unsaturated hydrocarbon

Organic functional groups	• define a functional group • recognise, and draw a range of, functional groups including aromatics, alkyl halides, alcohols, aldehydes, ketones, carboxylic acids and esters
Properties of alkyl halides	• compare the physical properties of alkyl halides with the alkanes from which they were made
Reactions of alkyl halides	• appreciate that alkyl halides undergo substitution reactions more readily that the alkanes from which they were synthesised • write equations for the reactions of alkyl halides to form primary, secondary and tertiary alcohols
Properties of alcohols	• recognise that the presence of hydrogen bonding leads to an increase in melting and boiling points compared to the corresponding alkanes. Hydrogen bonding also tends to make the alcohols more soluble than the corresponding alkanes in polar solvents such as water • understand that polyalcohols have much higher boiling points than the corresponding simple alcohols
Types of alcohols	• distinguish between primary, secondary and tertiary alcohols: name them and draw their structural formulae
Reactions of alcohols	• write balanced equations for the reactions of alcohols with sodium metal and carboxylic acids • understand that polyalcohols can react with polyacids to form polyesters • write equations for the oxidation of primary alcohols to form aldehydes when heated in the presence of copper catalysts or when treated with acidified dichromate solution. Name the products • write equations for the oxidation of primary alcohols by stronger oxidisers such as acidified permanganate solution or acidified hydrogen peroxide solution to produce carboxylic acids • write equations for the oxidation of secondary alcohols to produce ketones • recognise that tertiary alcohols do not undergo oxidation reactions
Properties of aldehydes and ketones	• understand that aldehydes tend to be less soluble in polar solvents than the alcohols from which they were synthesised

ORGANIC CHEMISTRY (CONTINUED)

Reactions of aldehydes	• write balanced equations for the oxidation of aldehydes to produce carboxylic acids. Name the reactants and products
Reactions of ketones	• understand that ketones cannot be oxidised further
Properties of carboxylic acids	• understand that carboxylic acids are weak acids • recognise that the pH of solutions of carboxylic acids tends to be higher than for solutions of strong acids with the same concentration
Reactions of carboxylic acids	• write equations for the reactions of carboxylic acids with carbonates, sodium hydrogencarbonate, metal oxides and hydroxides, reactive metals and alkaline solutions • written equations for the reactions of carboxylic acids with primary alcohols to form esters and name the products
Properties of esters	• understand that esters tend to be insoluble in water and that they have distinctive smells
Reactions of esters	• write equations for the hydrolysis of esters

THE PERIODIC TABLE

Periodic variations	• be familiar with the period variation of atomic radii, ionisation energy and chemical properties of the elements with increasing atomic number
Early history	• understand Mendeleev's contribution to the Periodic Table based on chemical properties and increasing atomic masses
Evidence for shells of electrons	• variation of ionisation energy as successive electrons are removed for may electron atoms • explain the principles of emission and absorption spectra (qualitative only)
The Bohr model of the atom	• describe the Bohr model of the hydrogen atom • understand the difference between shells, sub-shells and orbitals (mention quantum numbers)
Electron configurations	• write the electron configuration for atoms and simple ions in their ground states using sub-shells • predict the charges of ions formed from the main groups of the Periodic Table
Valence Theory	• apply understanding of atomic number and electron configurations to explain the periodic variation of chemical properties • a brief introduction to the concept of electronegativity as a measure of the tendency of an atom to attract electrons

Trends in the Periodic Table	• identify and explain the trends in the behaviour across periods and within groups:
	  • explain why metals in the main groups get less reactive from left to right and non-metals get more reactive
	  • explain why metals get more reactive and non-metals get less reactive as one descends the Periodic Table
	  • describe the variation in the acid-base properties of oxides as one crosses the Periodic Table
	  • a brief introduction to the concept of electronegativity as a measure of the tendency of an atom to attract electrons

GASES

Properties of gases	• be familiar with the properties of gases as described by Boyle's Law, Charles' Law and the ideal gas equation. Understand how the kinetic theory of matter explains these properties, including gas mixtures and non-ideal behaviours of real gases
Calculations involving gases	• perform calculations associated with the gas laws, including finding the molar volume of an ideal gas, convert temperature to absolute temperature and vice versa • be familiar with the molar volume of ideal gases at standard temperature and pressure (STP) and under standard laboratory conditions (SLC) for gases collected over vapour pressure equilibrium • calculate the masses or volumes of dried gases produced during electrolysis

THERMOCHEMISTRY

Heat content and enthalpy	• understand the concepts of heat content and enthalpy for chemical reactions
Energy in chemical reactions	• recognise that forming bonds releases, and that breaking bonds absorbs, energy • recall that exothermic reactions release energy and endothermic reactions absorb heat energy • construct enthalpy/potential energy diagrams including activation energy
Thermochemical equations	• write the heat of reaction as a reactant or product or write thermochemical equations using ΔH notation
Heat energy calculations	• calculate the heat energy released or absorbed during a chemical reaction for a known mass or reactant or product
Calorimetry	• calibrate a calorimeter using an electrical heating coil • calculate the heat energy involved when a known mass of substance undergoes a measured change in temperature $E_H = mc\Delta T$ • calculate the heat energy required for a known mass of substance to undergo a change in state from solid to liquid or from liquid to gas • use the techniques of calorimetry to measure the heat of reaction
Bond energy	• define bond energy • analyse the bonds that must be broken and formed in the course of a chemical reaction and calculate the heat of reaction using a table of bond energies
Hess' Law	• use Hess' Law of the additivity of heats of reaction to calculate ΔH for unknown reactions by summing thermochemical equations

KINETICS

Reaction rate

- define the reaction rate as the rate at which product is produced or minus the rate at which a reactant is consumed
- find the average rate by dividing the change in the amount of product by the time taken:

$$\text{average rate} = \frac{\Delta n_{product}}{t}$$

- find the average rate by dividing the change in the concentration of product by the time taken:

$$\text{average rate} = \frac{\Delta c_{product}}{t}$$

Factors affecting the rate

- use the collision theory to explain the expected changes in rates of reactions:
  - concentration of reactants (pressure for gases)
  - surface area over which the reactants are in contact
  - temperature of reactants

Activation energy

- construct a diagram to show the distribution of kinetic energy for molecules at a particular temperature
- explain the increase in reaction rate with temperature by referring to the increase in the proportion of molecules with sufficient kinetic energy to react

Catalysts and enzymes

- construct a potential energy diagram for a reaction to show the effect of a catalyst on the activation energy:
  - the effect of catalysts or enzymes

CHEMICAL EQUILIBRIUM

Chemical equilibria	• understand that not all reactions go to completion and that products may be converted back to reactants • recognise that equilibrium has been reached if there are significant amounts of products and reactants present with no discernible change to their concentrations over time • understand that at equilibrium the rate of the forward and reverse reactions are equal
The law of equilibrium	• recall the law of equilibrium and recognise that it is a consequence of the competing reactions having equal rates
Equilibrium constant, K_c	• define the equilibrium constant for a reaction based on the coefficients of reactants and products • realise that concentrations of pure substances are incorporated into K • recognise that the size of the equilibrium constant is a measure of the extent to which a reaction goes to completion • perform calculations on the concentrations of reactants or products using equilibrium constants

Changes to a system at equilibrium	• predict the effects of changing the conditions of a system at equilibrium by considering the effect on the rates of competing reactions:
	  • changing the concentration of a species in solution
	  • changing the temperature
	  • changing the volume of a container of gaseous reactants and products
	  • changing the partial pressure of one gaseous reactant
	  • adding an inert substance
	  • competing equilibria
	  • adding a catalyst

Le Chatelier's Principle	• apply Le Chatelier's principle to each of the changes above and understand its limitations
Acid base equilibria	• understand ionisation of strong and weak acids in aqueous solutions • define K_a for a monoprotic acid. Recognise that in aqueous solutions, $K_w = [H^+_{(aq)}][OH_{(aq)})] = 10^{-14}$ at 25^oC • calculate the pH of known concentrations of strong monoprotic acids • calculate the pH of known concentrations of weak monoprotic acids • calculate the pH of solutions of strong bases

ASSESSMENT

Criterion-based assessment is a form of outcomes assessment which identifies the extent of student achievement at an appropriate end-point of study. Although assessment in the classroom is continuous, much of it is formative, and is done to help students identify what they need to do to attain the maximum benefit from their study of the course. Therefore, assessment for summative reporting to the TQA should focus on what both teacher and student understand to reflect end-point achievement.

The primary audience for assessment is the student and the teacher, but may also include parents when appropriate.

The standard of achievement each student attains on each criterion is recorded as a rating 'A', 'B', or 'C', according to the outcomes specified in the standards section of the course.

A 't' notation must be used where a student demonstrates any achievement against a criterion less than the standard specified for the 'C' rating. The 't' notation is not described in course standards.

A 'z' notation is to be used where a student provides no evidence of achievement at all.

Providers offering this course must participate in the quality assurance processes as specified by the Tasmanian Qualifications Authority to ensure provider validity and comparability of standards across al awards. Further information on quality assurance processes, as well as on assessment, is available in the TQA Senior Secondary Handbook or on the website at http://www.tqa.tas.gov.au.

Internal assessment of all criteria will be made by the school. Schools will report the student's rating for each criterion to the Tasmanian Qualifications Authority.

The Tasmanian Qualifications Authority will supervise the external assessment of designated criteria (*). The ratings obtained from the external assessments will be used in addition to those provided from the school to determine the final award.

QUALITY ASSURANCE PROCESSES

The following processes will be facilitated by the TQA to ensure there is:

- a match between the standards for achievement specified in the course and the standards demonstrated by students
- community confidence in the integrity and meaning of the qualification.

Process – the Authority gives course providers feedback about any systematic differences in the relationship of their internal and external assessments and, where appropriate, seeks further evidence through audit and requires corrective action in the future.

EXTERNAL ASSESSMENT REQUIREMENTS

The external assessment of this course focuses on the assessment of criteria 5, 6, 7 and 8.

COURSE CRITERIA

The assessment for Chemistry, TQA level 3, will be based on the degree to which the student can:

1. demonstrate personal skills to organise and complete activities
2. develop, interpret and evaluate chemistry experiments
3. collect, process and communicate information
4. demonstrate understanding of the application and impact of chemistry in society
5. *demonstrate an understanding of the fundamental principles and theories of electrochemistry
6. *demonstrate knowledge and understanding of the principles and theories of thermochemistry, kinetics and equilibrium
7. *demonstrate knowledge and understanding of the properties and reactions of organic and inorganic matter
8. *apply logical processes to solve quantitative chemical problems.

* = externally assessed criteria

STANDARDS

CRITERION 1 DEMONSTRATE PERSONAL SKILLS TO ORGANISE AND COMPLETE ACTIVITIES

Rating 'C'	Rating 'B'	Rating 'A'
A student can:	A student can:	A student can:
• use techniques and equipment safely and methodically	• use techniques and equipment safely and methodically	• use techniques and equipment safely and methodically, applying them to new contexts
• follow instructions accurately	• follow instructions accurately	• follow instructions accurately, adapting to new circumstances
• demonstrate time management skills to negotiate or meet deadlines	• demonstrate self-direction and time management skills to negotiate or meet deadlines	• consistently demonstrate self-direction and time management skills to negotiate or meet deadlines
• undertake and complete a range of activities	• undertake and complete most activities	• persevere independently to undertake and complete most activities
• participate in group activities.	• participate constructively in group activities.	• participate constructively and show initiative in group activities.

CRITERION 2 DEVELOP, INTERPRET AND EVALUATE CHEMISTRY EXPERIMENTS

Rating 'C'	Rating 'B'	Rating 'A'
A student can:	A student can:	A student can:
• formulate a hypothesis to explain observations	• formulate an appropriate hypothesis to explain observations	• formulate an appropriate and readily testable hypothesis to explain observations
• design an experiment to test a concept	• design an experiment to test a concept using appropriate elements of experimental design	• design an experiment to test a concept using appropriate elements of experimental design and recognise the design limitations
• draw a conclusion, based on the results, which clearly relates to a hypothesis	• draw a valid conclusion, based on a sound interpretation of the results, which clearly relates to a hypothesis	• draw a reasoned conclusion based on a sound interpretation of the results highlighting the limitations and strengths of a hypothesis
• identify some limitations and sources of error in experimental design.	• identify the significant limitations and sources of error in experimental design.	• identify the significant limitations and sources of error in experimental design, explaining, where appropriate, relationships with theory.

CRITERION 3 COLLECT, PROCESS AND COMMUNICATE INFORMATION

Rating 'C'	Rating 'B'	Rating 'A'
A student can:	A student can:	A student can:
• use a variety of relevant, up to date resources	• use a variety of relevant, up to date resources and evaluate their reliability	• use a variety of relevant, up to date resources and critically evaluate their reliability
• attempt to document sources of information using a recognised scientific format	• correctly document sources of information using some aspects of a recognised scientific format	• correctly document sources of information using a recognised scientific format
• reorganise information	• reorganise information in a logical sequence	• reorganise information in a clear, logical sequence
• attempt to select and use appropriate scientific format for the communication of information.	• correctly select and use appropriate scientific format for the communication of information.	• independently and correctly select and use appropriate scientific format for the communication of information.

CRITERION 4 DEMONSTRATE UNDERSTANDING OF THE APPLICATION AND IMPACT OF CHEMISTRY IN SOCIETY

Rating 'C'	Rating 'B'	Rating 'A'
A student can:	A student can:	A student can:
• demonstrate an understanding of the chemistry background to an issue	• demonstrate a good understanding of the chemistry background to an issue	• demonstrate a significant understanding of the chemistry background to an issue
• identifies the main components of an issue	• demonstrate a clear understanding of the significant components of an issue	• demonstrate clear understanding of the significant components of an issue and present a detailed and balanced discussion
• describe connections between some of the relevant influences (ethical, political, cultural, social, economic) on an issue	• clearly describe connections between most of the relevant influences (ethical, political, cultural, social, economic) on an issue	• clearly describe connections between all of the significant relevant influences (ethical, political, cultural, social, economic) on an issue, showing an appreciation of the complexity of an issue
• form a reasoned conclusion, based on relevant evidence.	• form a reasoned conclusion, linked to relevant evidence.	• form a reasoned conclusion, linked to relevant evidence, assessing the relative impact of influences on decision making.

CRITERION 5 DEMONSTRATE AN UNDERSTANDING OF THE FUNDAMENTAL PRINCIPLES AND THEORIES OF ELECTROCHEMISTRY

Rating 'C'	Rating 'B'	Rating 'A'
A student can:	A student can:	A student can:
• use given half-equations to balance redox equations and predict the reactions occurring between oxidisers and reducers	• given the species, construct half-equations to balance redox equations and predict the reactions occurring between oxidisers and reducers	• given the species, construct half-equations to balance redox equations and predict the reactions occurring between oxiders and reducers
• use the electrochemical series to predict the reactions between two species under standard conditions	• use the electrochemical series to predict the reactions that occur when more than two species are present under standard conditions	• use the electrochemical series to predict the reactions that occur when more than two species are present under standard conditions and suggest why some variations are observed
• draw a cell diagram and write half-equations for the reactions at each electrode in familiar electrochemical and electrolytic cells	• draw a cell diagram showing the movement of ions and electrons and write half-equations for the reactions at each electrode in familiar electrochemical and electrolytic cells	• draw a cell diagram showing the movement of ions and electrons and write half-equations for the reactions at each electrode in unfamiliar electrochemical and electrolytic cells
• describe the chemical processes associated with the corrosion of steel and describe a method to prevent it.	• describe and explain the chemical processes associated with the corrosion of metals and describe two or more methods that could be used to prevent it.	• describe and explain the chemical processes associated with the corrosion of metals and describe two or more methods that could be used to prevent it and identify the most appropriate technique.

CRITERION 6 DEMONSTRATE KNOWLEDGE AND UNDERSTANDING OF THE PRINCIPLES AND THEORIES OF THERMOCHEMISTRY, KINETICS AND EQUILIBRIUM

Rating 'C'	Rating 'B'	Rating 'A'
A student can:	A student can:	A student can:
• interpret energy diagrams	• interpret energy diagrams and explain that the enthalpy of reaction is the result of making and breaking of bonds	• interpret energy diagrams and explain that the enthalpy of reaction is the result of making and breaking of bonds
• explain the variation in reaction rates using collision theory and the concept of catalysis	• explain the variation in reaction rates using collision theory and the concepts of catalysis and the distribution of energy	• predict and explain the variation in reaction rates using collision theory and the concepts of catalysis and the distribution of energy
• identify a system at equilibrium and predict the effect of changes	• identify a system at equilibrium and predict and explain the effect of changes	• identify a system at equilibrium and predict and explain the changes understanding the limitations of Le Chatelier's principle
• perform routine calculations associated with thermochemistry, reaction rates and equilibrium.	• perform calculations associated with thermochemistry, reaction rates and equilibrium.	• perform multi-step calculations associated with thermochemistry, reaction rates and equilibrium.

CRITERION 7 DEMONSTRATE KNOWLEDGE AND UNDERSTANDING OF THE PROPERTIES AND REACTIONS OF ORGANIC AND INORGANIC MATTER

Rating 'C'	Rating 'B'	Rating 'A'
A student can:	A student can:	A student can:
• draw and name organic molecules including simple aromatic and aliphatic molecules with one functional group	• draw and name organic molecules including simple aromatic and aliphatic molecules with one or more functional groups	• draw and name organic molecules including simple aromatic and aliphatic molecules with one or more functional groups, including isomeric variations and addition polymers
• identify variations in the physical properties of molecules containing different functional groups and use these properties to identify functional groups	• identify and use the concept of bond polarity to recognise variations in the physical properties of molecules containing different functional groups	• identify and use the concept of bond polarity to explain variations in the physical properties of molecules containing different functional groups
• write simple equations for the common reactions of molecules with a range of functional groups	• write equations for the reactions of molecules with a range of functional groups	• write equations for the reactions of molecules with a range of functional groups and reagents
• write electron configurations for elements using sub-shells, use valence theory to explain the periodic variation of the chemical properties of the s and p block elements and identify the trends in the behaviour of elements	• write electron configurations for elements using sub-shells, use valence theory to explain the periodic variations of the chemical properties of the s and p block elements and identify and explain the trends in the behaviour of elements	• write electron configurations for elements using sub-shells, use valence theory to explain the periodic variations of the chemical properties of the s and p block elements and identify and explain the trends and anomalies in the behaviour of elements
• explain observed behaviours of gases using the Kinetic Molecular Theory, and apply the gas laws and gas equations to relevant situations.	• explain observed behaviours of gases, including gas mixtures, using the Kinetic Molecular Theory, and apply the gas laws and gas equations to relevant situations.	• explain observed behaviours of gases, including gas mixtures and non-ideal behaviours of real gases, using the Kinetic Molecular Theory and apply the gas laws and gas equations to relevant situations.

CRITERION 8 APPLY LOGICAL PROCESSES TO SOLVE QUANTITATIVE CHEMICAL PROBLEMS

Rating 'C'	Rating 'B'	Rating 'A'
A student can:	A student can:	A student can:
• perform routine organic and inorganic stoichiometric calculations associated with volumetric analysis for organic and inorganic chemistry	• perform organic and inorganic stoichiometric calculations associated with volumetric analysis, including acid-base and redox titrations	• perform organic and inorganic stoichiometric calculations associated with volumetric analysis, including acid-base and redox titrations incorporating unfamiliar reactants
• perform routine calculations to find the mass or volume of reactants or products including gases	• perform stoichiometric calculations to find the mass or volume of a reactant or product including gases and solutions including limiting quantities	• perform multi-step stoichiometric calculations to find the mass or volume of a reactant or product including gases and solutions including limiting quantities
• perform routine calculations associated with electrochemistry	• perform calculations associated with electrochemistry	• perform calculations associated with electrochemistry in complex systems
• perform routine calculations associated with thermochemistry, kinetics and equilibrium.	• perform calculations associated with thermochemistry, kinetics and equilibrium.	• perform calculations associated with thermochemistry, kinetics and equilibrium, recognising their limitations.

QUALIFICATIONS AVAILABLE

Chemistry, TQA level 3 *(with the award of)*:

PRELIMINARY ACHIEVEMENT

SATISFACTORY ACHIVEMENT

COMMENDABLE ACHIEVEMENT

HIGH ACHIEVEMENT

EXCEPTIONAL ACHIEVEMENT

AWARD REQUIREMENTS

The final award will be determined by the Tasmanian Qualifications Authority from the 12 ratings (8 ratings from the internal assessment and 4 ratings from the external assessment).

The minimum requirements for an award in Chemistry are as follows:

EXCEPTIONAL ACHIEVEMENT (EA)

10 A, 2 B ratings (3 A, 1 B from external assessment)

HIGH ACHIEVEMENT (HA)

4 A, 5 B, 3 C ratings (1 A, 2 B and 1 C from external assessment)

COMMENDABLE ACHIEVEMENT (CA)

6 B, 5 C ratings (2 B, 2C from external assessment)

SATISFACTORY ACHIEVEMENT (SA)

10 C ratings (3 C from external assessment)

PRELIMINARY ACHIEVEMENT (PA)

6 C ratings

A student who otherwise achieves the ratings for a CA (Commendable Achievement) or SA (Satisfactory Achievement) award but who fails to show any evidence of achievement in one or more criteria ('z' notation) will be issued with a PA (Preliminary Achievement) award.

COURSE EVALUATION

Formal evaluation of the course will be undertaken during the second and fourth years of the accreditation. An evaluation report will be provided by the TQA.

The evaluations will focus on identifying any issues in regard to:

- the match between standards for achievement specified in the course and the standards demonstrated by students
- community confidence in the integrity and meaning of the qualifications
- access delivery and resources

and, if appropriate make recommendations regarding changes to the course.

COURSE DEVELOPER

Department of Education

ACCREDITATION

The accreditation period for this course is 1st January 2009 – 31st December 2013.

VERSION HISTORY

Version 1 – Accredited 1st October 2008 for use in 2009 – 2013.

Version 1.a – Addition of dot point relating to electronegativity to subheadings ‘Valence Theory’ and ‘Trends in the Periodic Table’.