UNIVERSITY OF TASMANIA

School of Chemistry

Faculty of Science, Engineering & Technology

KRA113

Chemistry 1A

Unit Outline 2009

The latest version of this unit outline is available on the web at
http://www.utas.edu.au/chem/chem1.htm
(This version updated: 19/02/2009)

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Contents

Note that some of the lecture topics in KRA113 (Chemistry 1A, Semester 1) and KRA114 (Chemistry 1B, Semester 2) have swapped in recent years, as have the topic lecturers and the number of lectures given in each topic. For exam preparation, it will thus be useful to revise past test and exam papers from both units. Refer to details supplied by the topic lecturers regarding changes to the topic over previous years that have affected the relevance of past exam questions.

Introduction

This guide has been produced to assist you in your study of the first year chemistry unit KRA113 (Chemistry 1A). It contains a description of the unit, an overall summary and detailed objectives of various components of the unit.

It is recommended that you use the detailed topic objectives to check your progress. If you do not understand the material being delivered or are uncertain of the desired outcomes in any part of the unit consult your lecturer, demonstrator or unit coordinator.

Unit summary

Unit code	KRA113
Unit title	Chemistry 1A
Unit description	This unit (along with Chemistry 1B in Semester 2) is the required prerequisite for students intending to major in Chemistry and for those intending to proceed to any second-year chemistry units. The unit builds on the introduction to chemistry given in year 12 (TCE CHM5C) and provides a foundation to four of the sub disciplines of chemistry: analytical, inorganic, organic and physical chemistry. Emphasis is placed on: • The development of an understanding of the underlying concepts in chemistry, so that generalisations regarding the physical and chemical properties of substances can be made. • The development of problem solving ability. • The expansion of the skills necessary to carry out experiments safely and efficiently in the laboratory.
Teaching staff	Dr Greg W Dicinoski, Dr Emily F Hilder and Dr Jason A Smith
Campus & mode	Hobart, internal
Unit weight	12.5%
Teaching pattern	The unit consists of 3 lectures and 1 tutorial per week for 13 weeks, and 3 hours of laboratory for 8 weeks.
Prerequisites	It is expected that students will have studied and gained a minimum award of SA in TCE Chemistry C (12 CH856/ CHM5C or its equivalent). *See handbook entry for alternative prerequisites, such as via bridging programs.*
Corequisites	None
Mutual exclusions	All other Semester 1 first year chemistry units
Assessment	Exam 60%, test 10%, assignments 10%, laboratory 20%
Required texts	• JW Moore, CL Stanitski and PC Jurs, *Chemistry: the Molecular Science*, 3rd edn • J McMurry, *Fundamentals of Organic Chemistry*, Brookes/Cole, 6th edn • DA Skoog, *Fundamentals of Analytical Chemistry*, 8th edn, *Ch 30* only (used in Semester 2 only, but comes

free with the textbook bundle at the bookshop)
- *Chemistry 1A Lecture Notes*, UTas (from UniPrint)
- *Chemistry 1A Laboratory Manual*, UTas (from UniPrint)

Recommended texts

- Molecular models for organic & inorganic chemistry (useful for visualising the 3D shapes of molecules)
- S McMurry, *Study Guide and Solutions Manual to Fundamentals of Organic Chemistry*, Brookes/Cole
- G Aylward and T Finlay, *SI Chemical Data*, Wiley

Learning outcomes

On completion of this unit, you should be able to:

- Demonstrate knowledge and understanding of chemical principles and theories and in so doing be able to appreciate the unifying themes in chemistry.
- Apply chemical principles and theories to predict and explain the chemical and physical properties of substances, their structure and the interactions that take place between them.
- Demonstrate an understanding of the central role of chemistry in other branches of natural science, such as biology, geology and physics and to recognise the central role that chemistry has in understanding the natural world.
- Demonstrate problem solving skills from experimental and theoretical approaches.
- Know when to accept evidence contrary to established beliefs.
- Demonstrate awareness that chemistry is a living and rapidly developing science.

Generic graduate attributes

The University has defined a set of generic graduate attributes that can be expected of all graduates. The policy document can be found at: "http://www.admin.utas.edu.au/academic/acservices/meetings/Senate/Appendix/3_01D1.doc". Details of the way several generic attributes are addressed in this unit are described below.

Generic attribute	Activity	Assessment	Benefits
Knowledge	Lectures	Test, exam	Professional knowledge of chemical principles
Problem-solving skills	Assignments, lab sessions, tutorials,	Assignments, test, exam	Ability to solve real-world problems in chemistry
Laboratory competency	Practical work	Performance in lab sessions	Ability to work in a professional lab
Workplace safety	Safety course/ instruction in lab.	Satisfactory completion of safety course	Ability to take personal responsibility for safety

Prior knowledge and assumed background

Mathematical Background

A 30 question MyLO maths skills quiz has been designed to test for key inabilities in your mathematical knowledge. If you have problems in this quiz, it is vital to address them ahead of their use in upcoming laboratory experiments and lecture topics. The quiz is not compulsory, but we strongly suggest that you attempt it as soon as possible in order to realise any problem areas. Afternoon tutorials will be held early in the semester aimed at improving your mathematical skills (details to be provided later). Appendix A of the text (JW Moore, CL Stanitski and PC Jurs, *Chemistry: the Molecular*

Science, 3rd edn) has a good, short summary. In addition, various chapters taken from textbooks aimed at mathematics for students in the physical sciences are available through the MyLO ("Mathematics tutorial" page).

As part of your required mathematical knowledge for this unit, you should be able to;

- plot experimental data onto a suitable well labelled graph with appropriate scales.
- for an equation of the form $y = c + mx$, plot x, y data to obtain values of m and c from the slope and intercept respectively.
- manipulate equations with logarithms ($\log_{10}x$, $\ln x$) and exponents (10^x, e^x).
- use a scientific calculator. Many chemical calculations will involve either very small or very large numbers so that you must be able to use exponents and to carry out calculations on your calculator using both negative and positive powers of ten using the EXP key. You also should be able to use the log, ln, 10^x, and the e^x keys.
- be adept in algebra and be able to solve quadratic equations.

Calculators

A hand held calculator of any design (with all alphanumeric memories erased) can be used during the examinations. A suitable model is the Casio *fx-82AU*. It will be assumed that students are facile with the use of a scientific calculator and the questions will be set accordingly. Exam questions will sometimes specifically state that advanced functions of some calculators cannot be used to substitute, rearrange and solve equations. Thus, you should be prepared to do such algebraic methods by hand.

Chemical Background

As part of your required chemical knowledge for this unit, you should;

- know that ionic compounds dissociate in water to form ions.
- be familiar with the states of matter and the laws governing their interconversion.
- know the differences between elements, compounds and mixtures.
- be proficient at calculations involving concentrations of reagents in aqueous solutions (molarity and the mole concept).
- be able to write balanced (including ionic) equations for chemical reactions.
- be able to write balanced oxidation-reduction (redox) reactions and to understand that redox reactions involve electron transfer processes.
- be familiar with the concepts of temperature, pressure, moles, heat, potential energy, kinetic energy and their respective SI units.
- be able to use the Ideal Gas equation.
- know that chemical reaction rates depends on concentration and temperature.
- know the difference between ionic and covalent bonding.
- be able to list the different types of hydrocarbons and name them.
- be familiar with structural isomerism.
- understand the concept of a functional group, and be aware of some of the simple reactions of functional groups.
- for the 2nd topic ("Organic Chemistry"), be familiar with the material covered in the first topic ("Chemical Bonding and Chemical Structure"). (McMurry, Chapters 1 to 4)

Details of teaching arrangements

Lectures	Bonding and structure	Dr Emily F Hilder	12L
	Organic chemistry	Dr Jason A Smith	12L
	Thermodynamics & Colligative Props	Dr Greg W Dicinoski	13L

Lecture times and location Mon 12:00, Wed 9:00 & Fri 14:10:
Lecture Theatre Chem210.LT

Tutorials (problem solving sessions) Tues 9:00 and 10:00, Fri 10:00:
Lecture Theatre Chem329.

Room 107 (on level 1 the "Chem Club Room") may be used as a study room. There are numerous chemistry texts (donated by staff) available for your use—please do not remove these books from the room.

Study day During the study week at the end of Semester 1 a study day will be held in the Chemistry Building. This will include a BBQ and tutorials to focus on past examination papers in the unit.

Laboratory course

Laboratory classes begin in Week 4 of Semester I. The laboratory will be conducted in room 214 between 15.10-18.00. The class to which you have been allocated will be posted on the notice board in the foyer of the Chemistry building. If you cannot attend the class to which you have been allocated please see Dr Emily Hilder (Room 410).

When you come to the first laboratory class you must have with you:

1. A laboratory coat and a pair of safety glasses (obtainable from the TUU Shop).
2. Sturdy shoes that cover your entire feet (must have enclosed heels and offer good coverage of the top of your foot. No open toed shoes/sandals are allowed).
3. A laboratory manual (purchased from UniPrint).

You cannot commence the laboratory class without these items.

The practical section is an integral part of the teaching program and experiments have been designed to

- Complement the lectures where possible
- Increase skills in the handling of chemicals and equipment
- Introduce you to basic laboratory techniques of synthesis and analysis
- Allow you to gain an appreciation of the need to carry out experiments with due regard to the safety of yourselves and others

Although most students will have some laboratory experience from college, all of the practical skills required for these classes will be explained in writing and demonstrated where necessary.

In chemistry practicals it is necessary to make observations and measurements, followed by calculations using the data that has been accumulated, to obtain a final result. The assessment requirement includes a simple record of the process used to obtain the result and no further 'write up' of the experiment is required.

You are required to complete a short written ***pre-laboratory preparation*** before each laboratory session, which will be checked at the beginning of the session. These will involve sourcing information directly related to the experiment and normally does not require any other information than that contained within the lab manual. In addition, a ***five-minute quiz*** will be conducted at the commencement of each laboratory session that will involve either variants on the pre-laboratory preparation exercise or questions

directly related to the calculations and/or interpretation of the laboratory procedure or the expected experimental results of the experiment.

A demonstrator is assigned to each group of students and they will provide assistance where required. They may be contacted outside laboratory hours to assist you.

It is not always possible to have experiments directly related to the lectures or to synchronise them with the lectures, so that students should be prepared to use the laboratory experience as a learning exercise. Details of laboratory procedures and the experiments are provided in the laboratory manual.

Attendance requirements: The acquisition of practical skills is an essential component of the unit and a necessary requirement for subsequent study in chemistry.

Furthermore your attention is drawn to Academic Assessment Rule 2. Under *Clause 6.2* the School of Chemistry requires successful completion of the following;

"Students are required to attend a minimum of two-thirds of the laboratory classes and obtain a result of at least 45% for successful completion of the laboratory component". THIS REPRESENTS COMPLETION OF AT LEAST SIX EXPERIMENTS. SESSIONS MISSED DUE TO ILLNESS ETC (EVEN IF COVERED BY A MEDICAL CERTIFICATE) **ARE NOT** INCLUDED IN THE MINIMUM ATTENDANCE REQUIREMENTS.

If you are absent for a genuine reason (for which a written excuse, such as a medical certificate, will be required) an average mark will be given (the average being over all weeks that are not included in the period covered by a medical certificate, which includes all other absences that you may have). Due to scheduling limitations here will normally be no catch up of the experiments.

Each practical session is assessed out of 15. This is comprised of a mark out of ten given by your demonstrator based on the results handed in at the end of each practical session and also on your performance in the laboratory (including competence, skills, safety, knowledge, note keeping and participation). In addition, three marks are given for the five-minute quiz. Late arrival at the laboratory will reduce the time allowed for the quiz or prevent you from completing the quiz, as a group briefing on the experiment will commence directly after the quiz. The pre-laboratory preparation marked out of two, and you will not be allowed to attempt the experiment if this is not completed.

Occupational health and safety: The University is committed to providing a safe and secure teaching and learning environment. In addition to specific requirements of this unit you should refer to the University's policy at: http://www.admin.utas.edu.au/hr/ohs/pol_proc/ohs.pdf.

As part of the School of Chemistry's contribution and commitment to the teaching of Occupational Health and Safety you will be required to satisfactorily complete a *Laboratory Safety Course*, accessed through MyLO. This online course will be conducted as part of your laboratory course and **must be completed before the start of the laboratory course** (not required if completed in KRA114 or if you have a laboratory exemption). In order to pass the laboratory component of this unit you must score at least 16 out of 20 on the safety quiz. The safety course and quiz is available via MyLO – see the laboratory manual for more details.

Laboratory exemption: Students who are repeating the unit may be eligible for a laboratory course exemption. A necessary condition is that they have already obtained a mark of 60% or greater in the laboratory course. Any student seeking an exemption will need to make a written application to the Laboratory Coordinator.

Unit schedule

Details of Lectures (plus summaries of Laboratory, Assignment and Tut roster)

Week number	Week commenc. Monday	Mon 12.00 -12.50 Place: Lecture Theatre Chem210.LT	Wed 9.00 - 9.50 Place: Lecture Theatre Chem210.LT	Fri 14.10 - 15.00 Place: Lecture Theatre Chem210.LT	Lab	Tuts	Ass.
1	Feb 23		**Bonding & Structure** (Topic 1)			MyLO intro tut	
2	Mar 2		Emily Hilder			Topic 1	Topic 1
3	Mar 9	Public holiday	12 lectures			Topic 1	Topic 1
4	Mar 16				Expt 1	Topic 1	Topic 1
5	Mar 23		**Organic Chemistry** (Topic 2)		Expt 2	Topic 1	Topic 1
6	Mar 30		Jason Smith		Expt 3	Topic 2	Topic 2
7	Apr 6		12 lectures	Easter		Topic 2	Topic 2
7	Apr 13	Easter	Easter	Mid-semester Test		Topic 2	Topic 2
8	Apr 20				Expt 4	Topic 2	Topic 2
9	Apr 27				Expt 5	Topic 2	Topic 2
10	May 4		**Thermodynamics & Colligative Props** (Topic 3)		Expt 6	Topic 3	Topic 3
11	May 11		Greg Dicinoski		Expt 7	Topic 3	Topic 3
12	May 18		13 lectures		Expt 8	Topic 3	Topic 3
13	May 25					Topic 3	Topic 3
STUDY WEEK	June 1	TUTORIAL DAY DURING THIS WEEK					

Tutorials (problem solving sessions)
The topic lecturers give these tutorials. Typically a set of typical exam-type questions are pre-distributed and worked through during the tutorial. In addition, individual questions are very welcome from students. However, of course you are not limited to these times (we encourage you to see us at any stage). **Tutorials start in Week 2**. **Choose whichever tutorial time fits your schedule** (attend more than one if you want!). **Students are expected to attend the MyLO briefing sessions in Week 1** (see the following Section: they are not at the normal tutorial venue/time).

Semester I Week	Tuesday 9-10 in Lecture Theatre Chem329	Tuesday 10 - 11 in Lecture Theatre Chem329	Friday 10 - 11 in Lecture Theatre Chem329
1	*No tutorial*	*No tutorial*	*No tutorial*
2	Dr Hilder	Dr Hilder	Dr Hilder
3	Dr Hilder	Dr Hilder	Dr Hilder
4	Dr Hilder	Dr Hilder	Dr Hilder
5	Dr Hilder	Dr Hilder	Dr Hilder
6	Dr Smith	Dr Smith	Dr Smith
7	Dr Smith	Dr Smith	Dr Smith
8	Dr Smith	Dr Smith	Dr Smith
9	Dr Smith	Dr Smith	Dr Smith
10	Dr Dicinoski	Dr Dicinoski	Dr Dicinoski
11	Dr Dicinoski	Dr Dicinoski	Dr Dicinoski
12	Dr Dicinoski	Dr Dicinoski	Dr Dicinoski
13	Dr Dicinoski	Dr Dicinoski	Dr Dicinoski

MyLO briefing session in Week 1

These will be held in one-hour long afternoon sessions, your group allocation will be given in Week 1 on the first year chemistry notice board outside Lecture Theatre Chem210.LT in the foyer to the Chemistry Building.

Learning expectations and strategies

Expectations

The University is committed to high standards of professional conduct in all activities, and holds its commitment and responsibilities to its students as being of paramount importance. Likewise, it holds expectations about the responsibilities students have as they pursue their studies within the special environment the University offers.

The University's Code of Conduct for Teaching and Learning states:

> *Students are expected to participate actively and positively in the teaching/learning environment. They must attend classes when and as required, strive to maintain steady progress within the subject or unit framework, comply with workload expectations, and submit required work on time.*

Learning strategies

If you need assistance in preparing for study please refer to your lecturer. For additional information refer to the Learning Development website: http://www.utas.edu.au/assignmenthelp/.

If you will be using MyLO for the first time and would like some information on how to use MyLO refer to the Learning Online website: http://www.utas.edu.au/coursesonline/.

Assessment details

Examination	3 hrs (18 questions)	60%
	In June university examination period, covering all the material covered in Semester 1 (six equal length questions per topic).	
Mid-Semester Test	50 min (5 questions)	10%
	There will be a mid-semester test on Monday in Week 8 in the normal lecture time and venue covering the work of Semester 1 up to that time. There will be three questions on Topic 1 and two questions on Topic 2.	
Assignments	12 assignments	10%
Laboratory	8 x 3 hr practicals	20%

Specific attendance/performance requirements

In order to pass this unit you must achieve a minimum of 45% in both the examination and laboratory components. In addition, to obtain a pass in the laboratory course you must have submitted reports for at least 2/3 of the experiments (see previous section on the laboratory course for more details in attendance requirements).

How your final result is determined

From time to time, it may be necessary to re-scale marks to allow for what is determined to be either a relatively tough or easy assessment task compared with previous years. The procedure for this is governed by the Faculty policy available on the web (see link below). Final grades are determined in accordance with Faculty policy, which is also available on the web (see link below). The Faculty's Teaching & Learning Operational Guide No 3 will be followed in relation to withdrawals after census dates. All policies are located at http://fcms.its.utas.edu.au/scieng/scieng/policies.asp.

Submission of assignments and lab reports

MyLO Tutorial

A **compulsory** tutorial on the use of MyLO will be run during the first week of semester. Your allocated day to attend this tutorial will be posted on the First Year notice board outside Lecture Theatre Chem210.LT in the foyer to the Chemistry Building on Monday of Week 1. It is vital that you attend this session.

Assignments

The assignment load required for the Chemistry 1A unit consists of 12 weekly assignments completed via an Internet based approach using MyLO. In addition, two assignments are available from Week 1 that do not count towards your assessment (one is a chemistry revision and the other a maths skill tester). The format of the questions in these assignments will be: Multiple Choice; Short Answer; Matching; True/False; or Single Word/Phrase. Most assignments consist of 10 questions randomly assigned from a database of related questions. Correct answers are also randomised. Solutions will not be made available, though similar problems will be discussed in lectures/tutorials. You are very welcome to contact the topic lecturers with individual queries regarding solutions to particular questions.

There is a non-assessable *Concept Test* must be attempted before accessing the weekly assignments in Weeks 2-13. A minimum score of only 1 out of 10 is required. The *Concept Tests* are designed to offer instant feedback on your understanding of the concepts underlying the assignment questions. Incorrect responses have helpful tips on addressing misconceptions. We suggest that you make a real effort on the Concept

Tests. A suggestion is to *test yourself* by attempting them over just 10 minutes, respond with your first thought (long calculations won't be required) and then brush up on any problem areas. If you only opt for a token attempt at the Concept Tests, you can still benefit by referring back to the feedback given if you subsequently have a problem with an assignment question. Multiple attempts are allowed for the Concept Tests.

In order to **access** the assignments over the Internet you need to be using a standard, Java-enabled Web browser such as Netscape Navigator ver 4 or Microsoft Explorer ver 4 (or higher) with Sun Java (v1.5.0.07) applet loaded (see http://uconnect.utas.edu.au/software.htm). Your computer must have Internet access (from home, Chemistry or anywhere in the University) and be able to reach the University web site where the assignments are stored. The procedure is as follows:

Your *username* is: your e-mail POP name - that is, the first part (the **xxxxxxx**) of your e-mail address: **xxxxxxx**@postoffice.utas.edu.au**.**

Your *Password* is: your POP e-mail password.

The weekly assignments will become available every Monday at 00:00 (midnight Sunday) as we cover the material in lectures, and once active will remain so until 00:00 Tuesday (midnight Monday) of the following week. The assignments will again be reactivated before the examinations in order to give you practice for the final examination (but any late attempts will not count towards your grade for the unit).

- The program used is called MyLO, which is an Internet based tuition program.
- A study guide issued at the MyLO tutorial contains further MyLO usage information.
- The MyLO Web address (URL) is: http://www.utas.edu.au/coursesonline/

The assignment schedule is shown below;

Teaching Week	Date assignment available	MyLO assignment label	Staff member	Topic
1	Feb 23	Ass1_08_chem_revision	Dr Greg Dicinoski	Training with MyLO/chemistry refresher (*not assessed*)
1	Feb 23	Ass1_08_maths_skills	Dr Greg Dicinoski	Maths Skills Quiz (*not assessed*)
2	March 2	Ass2_08_EFH	Dr Emily Hilder	Atomic Structure / Periodic Table
3	March 9	Ass3_08_EFH	Dr Emily Hilder	Bonding 1
4	March 16	Ass4_08_EFH	Dr Emily Hilder	Bonding 2
5	March 23	Ass5_08_EFH	Dr Emily Hilder	Bonding 3
6	March 30	Ass6_08_JAS	Dr Jason Smith	Organic 1
7	April 6	Ass7_08_JAS	Dr Jason Smith	Organic 2
8	April 20	Ass8_08_JAS	Dr Jason Smith	Organic 3
9	April 27	Ass9_08_JAS	Dr Jason Smith	Organic 4
10	May 4	Ass10_08_GWD	Dr Greg Dicinoski	Thermo 1
11	May 11	Ass11_08_GWD	Dr Greg Dicinoski	Thermo 2
12	May 18	Ass12_08_GWD	Dr Greg Dicinoski	Thermo 3
13	May 25	Ass13_08_GWD	Dr Greg Dicinoski	Colligative

Lab reports

Laboratory reports consist of pages to be completed the laboratory manual. Your demonstrator grades this laboratory report and your performance in the lab each session. Lab reports must be submitted to your demonstrator by the end of each session or, at the discretion of the demonstrator, the end of the following working day.

Requests for extensions

Applications for extensions due to extenuating circumstances (such as a medical condition) are required **before the due date of the work** and should be made known to the MyLO Coordinator (for assignments) or the Laboratory Coordinator (for laboratory reports) as soon as practicable. Students without a medical certificate for absence will receive zero for the experiments/assignments not submitted.

Review of results and appeals

All students may have their results reviewed in accordance with the Faculty policy available on the web at http://fcms.its.utas.edu.au/scieng/scieng/policies.asp (policy 6).

Plagiarism

Plagiarism is a form of cheating. It is taking and using someone else's thoughts, writings or inventions and representing them as your own; for example, using an author's words without putting them in quotation marks and citing the source, using an author's ideas without proper acknowledgment and citation, or copying another student's work.

If you have any doubts about how to refer to the work of others in your assignments, please consult your lecturer or tutor for relevant referencing guidelines, and the academic integrity resources on the web at http://www.utas.edu.au/tl/supporting/academicintegrity/index.html. The intentional copying of someone else's work as one's own is a serious offence punishable by a range of penalties that may range from a fine or deduction/cancellation of marks to, in the most serious of cases, exclusion from a unit, a course, or the University. Details of penalties that can be imposed are available in the Ordinance of Student Discipline – Part 3 Academic Misconduct, see;

http://www.utas.edu.au/universitycouncil/legislation/ord9.pdf.

The University reserves the right to submit assignments to plagiarism detection software, and might then retain a copy of the assignment on its database for the purpose of future plagiarism checking.

For further information on this statement and general referencing guidelines, see http://www.utas.edu.au/plagiarism/.

At the beginning of the lab course you will be required to sign a declaration that all the material in your assignments or laboratory reports is your own work except where there is clear acknowledgement or reference to the work of others and that you are aware of the University's plagiarism policy.

Unit evaluation and student feedback

The School of Chemistry is an active participant in the Student Evaluation of Teaching and Learning (SETL) program. This means that towards the end of semester you will be given the opportunity to fill in a survey form in which you will be asked to comment on the good and bad features of this unit. As a result of previous SETL feedback we have, for example, improved the topics that are taught in the unit, the provision of lecture notes, recording of lectures and overhead material, and the way that the assignment workload is managed. As well as SETL, you should not hesitate to approach the Unit Coordinator or lecturer concerned if you have any problems during the year. Any difficulties may also be raised with the Chemistry Club, which arranges regular meetings between student representatives and the Head of the School.

Staff contacts and responsibilities

The following staff have specific responsibilities for 1st year students. You are welcome to contact the appropriate member of staff about any queries you may have by seeing them at their offices, phoning or emailing. The pigeonholes near the reception may also be used for contacting staff. Enquiries regarding the overall course should be directed to the Unit Coordinator. Students are also welcome to discuss particular problems with the Head of School, Prof Brian Yates (Brian.Yates@utas.edu.au). There is a "suggestion box" available in the foyer for constructive, confidential comments.

staff member		responsibilities	contact/office location
Dr Michael Gardiner		**Unit Coordinator**	6226 2404 Michael.Gardiner@utas.edu.au (room 301)
Dr Greg Dicinoski		**MyLO Coordinator** lectures - thermo. & collig. props.	6226 2166 Greg.Dicinoski@utas.edu.au (room 403)
Dr Emily Hilder		**Laboratory Coordinator** lectures - bonding & structure	6226 7670 Emily.Hilder@utas.edu.au (room 410)
Dr Jason Smith		lectures - organic	6226 2182 Jason.Smith@utas.edu.au (room 435)
Mr Jarrod Coad		laboratory support	6226 2164 Jarrod.Coad@utas.edu.au (room 216)
Mrs Kerrie-Anne Berger		Receptionist - medical certificates for missed work	6226 2121 Secretary@chem.utas.edu.au (room 204a)
Prof Brian Yates		Head of School	6226 2167 Brian.Yates@utas.edu.au (room 204)

First year notice board

The notice board outside Lecture Theatre Chem210.LT in the foyer to the Chemistry Building is used to post laboratory information and various unit related advertisements.

Further information and assistance

If you are experiencing difficulties with your studies or assignments, have personal or life planning issues, disability or illness which may affect your course of study, you are advised to raise these with your lecturer in the first instance.

There are a range of University-wide support services available to you including Student Services, International Services and Learning Development. Please refer to the Current Students homepage at: http://www.utas.edu.au/students/.

Should you require assistance in accessing the Library visit their website for more information at http://www.utas.edu.au/library/.

The University aims to ensure that your time here is enjoyable and rewarding. However if you have a concern or complaint that is affecting your study, the University has created a web page (http://www.admin.utas.edu.au/ac_serv/complaints_info.html) to offer you guidance on solving these problems. Most issues can be resolved informally and therefore you are encouraged to discuss the matter with the person involved as a first step. The web page deals primarily with complaints concerning assessment and academic progress; however advice on who to contact concerning complaints about non-academic issues is also included.

Peer Assisted Study Sessions (PASS)

This scheme is being offered by CALT (Centre for the Advancement of Learning and Teaching) in 2009 for Chemistry 1A and 1B. Sessions times will be made available at the start of semester. The Peer Assisted Study Sessions program (PASS: http://www.utas.edu.au/assignmenthelp/PASS.htm) is an academic support program, available to all students studying in selected units. PASS offers regular, out-of-class sessions focussing on integrating course content (what to learn) with academic reasoning and study skills (how to learn). PASS sessions are facilitated by PASS Leaders, who are students that have recently completed the unit. The sessions are informal seminars, in which students review notes, discuss readings, develop study tools and prepare for examinations. Data from universities, both national and international, indicate that PASS students earn higher subject grades, and withdraw less often, than non-PASS participants (in units where the program is offered).

Electronic resources

School of Chemistry home page	http://www.utas.edu.au/chem/
School of Chemistry safety page	http://www.utas.edu.au/chem/chemsafety.htm
University's MyLO site	http://www.utas.edu.au/coursesonline/
University Handbook entry for Chemistry 1A	http://www.utas.edu.au/units/KRA113/

Unit content

The general objectives of this syllabus are achieved by a study of the following topics during the semester:

Topic 1 Chemical Bonding and Chemical Structure

Topic Outline:

The Periodic Table revisited:

- what is periodic about the Periodic Table?
- pre 1900
- post 1900
- Group names and numbers
- trends in Groups and Periods

Atomic Structure: (Moore, Stanitski and Jurs, Chapters 2 and 7)

- protons, neutrons and electrons
- an introduction to spectroscopy
- the properties of light (electromagnetic radiation)
- emission and absorption of radiation
- atomic spectra and quantisation of energy levels
- electron orbits and electronic orbitals
- quantum numbers
- Lewis model of atoms and ions
- electronic structure and the Periodic Table

Chemical Bonds: (Moore, Stanitski and Jurs, Chapter 8)

- energy changes during the formation of a chemical bond
- bond energy and bond length
- valence electrons
- electronegativity and the nature of the chemical bond
- will a bond be ionic, polar covalent or covalent?
- writing Lewis structures for the Main Group elements
- bond order, bond energy and bond length
- bond energies and heats (enthalpies) of reaction
- resonance structures

The Shapes of Molecules: (Moore, Stanitski and Jurs, Chapter 9)

- VSEPR Model
- co-ordination numbers
- Valence Bond Model
- hybrid orbitals
- sigma and pi bonds
- Molecular Orbital Model
- bonding and anti-bonding molecular orbitals

Intermolecular Interactions and Physical Properties

Attractive Forces Between Molecules: (Moore, Stanitski and Jurs, Chapter 9)

- van der Waals forces :- dipole-dipole and London dispersion forces
- hydrogen bonds
- effect on physical properties such as vapour pressure, boiling point, melting point and surface tension
- types of crystals

Topic 2 Organic Chemistry: Structure and reactions

This section aims to develop an understanding of the basic structural principles and reactions of organic chemistry. Lectures will cover fundamental concepts such as structure (including stereochemistry) and reactions of compounds with one functional group. The main emphasis will be on explaining the mechanisms whereby organic compounds react.

Assumed background:
Structure and bonding of organic compounds and the naming of simple alkanes and alkenes as described in McMurry Chapter 1 and sections 2.1 to 2.4 in Chapter 2 together with the concurrently taught material in the "Chemical Bonding and Chemical Structure" topic.

Topic Outline:

1. Introduction to organic reactions

Covalent bonding, σ and π bonds, sp^3, sp^2 and sp orbitals; hybridisation; three dimensional shapes; bond polarity and electronegativity; making and breaking a covalent bond; nucleophiles, electrophiles and free radicals; carbocations, carbanions and their 3D shape; basic reaction types.
Ref. : *Fundamentals of Organic Chemistry* Chapters 1 and 3

2. Alkenes and alkynes

Nomenclature, general formulae, index of hydrogen deficiency, conjugated dienes; *cis* and *trans* isomerism (insect pheromones and retinal, the chemistry of vision); *E,Z* nomenclature, addition reactions to alkenes (addition of hydrogen, halogens, hydrogen halides, water), Markovnikov's rule, energy diagrams, transition states, reaction intermediates; elimination reactions (synthesis of alkenes), dehydrohalogenation, dehydration.
Ref. : *Fundamentals of Organic Chemistry* Chapters 3 and 4

3. Aromatic compounds

Structure of benzene, resonance; nomenclature; electrophilic aromatic substitution, halogenation, nitration, sulfonation, Friedel-Crafts alkylation, Friedel-Crafts acylation; oxidation and reduction; polycyclic aromatic and heteroaromatic compounds.
Ref. : *Fundamentals of Organic Chemistry* Chapter 5

4. Stereochemistry

Representing 3-D structures, sawhorse projections, Newman projections, wedge-shaped, normal and dashed lines; conformational isomerism of alkanes and cycloalkanes; *cis-trans* isomerism of cycloalkanes; chiral and achiral objects, stereogenic centres, enantiomers; chirality in nature; optical activity, specific rotation; *R, S* specification of configuration; compounds with two or more chiral centres, enantiomers, diastereomers, meso compounds; racemic mixtures and resolution.
Ref. : *Fundamentals of Organic Chemistry* Chapters 2 and 6

5. Alkyl halides

Nomenclature; synthesis; electrophilic addition; nucleophilic substitution of alkyl halides, S_N1 and S_N2 reactions; biological substitution reactions; Grignard reactions; elimination reactions.
Ref. : *Fundamentals of Organic Chemistry* Chapter 7

6. Alcohols, ethers, phenols and thiols

Nomenclature; hydrogen bonding, acidity and basicity; synthesis; reactions of alcohols, elimination reactions (dehydration), substitution reactions (conversion to alkyl halides, ethers), oxidation; thiols, oxidation, biological importance of the thiol group and derivatives.

Ref. : *Fundamentals of Organic Chemistry* Chapter 8

Some specific objectives for this topic:

After completing this topic you should know and/or understand the following

1. Be familiar with covalent bonding (σ and π bonds) and bond polarity.
2. Know about bond hybridisation and the three dimensional shapes of simple hydrocarbons.
3. Know about breaking and making a covalent bond.
4. Recognise carbocations, carbanions, nucleophiles, electrophiles and free radicals.
5. Know the 3D shapes of carbocations, carbanions and free radicals.
6. Be able to classify organic reactions into the basic types.
7. Be capable of naming a given structure and generating a structure from a systematic name for alkanes, alkenes and alkynes.
8. Know how to write general formulae.
9. Be able to calculate and use the index of hydrogen deficiency.
10. Recognise a conjugated diene.
11. Understand *cis* and *trans* isomerism and *E,Z* nomenclature.
12. Understand addition reactions to alkenes including: addition of hydrogen, halogens, hydrogen halides, water.
13. Know about and use Markovnikov's rule.
14. Recognise energy diagrams.
15. Know about transition states and reaction intermediates.
16. Be able to use elimination reactions to design syntheses of alkenes via dehydrohalogenation and dehydration reactions.
17. Be able to apply systematic nomenclature to aromatic compounds.
18. Be familiar with the structure of benzene.
19. Understand and use electrophilic aromatic substitution, particularly: halogenation, nitration, sulfonation, Friedel-Crafts alkylation, Friedel-Crafts acylation.
20. Recognise polycyclic aromatic and heteroaromatic compounds and their connection to aromatic carcinogens.
21. Be familiar with 3-D molecular structure representations: particularly the use of wedge and dashed lines, sawhorse projections and Newman projections.
22. Understand conformational isomerism of alkanes and cycloalkanes and *cis-trans* isomerism of cycloalkanes.
23. Know about and distinguish between chiral and achiral objects.
24. Recognise a stereocentre and chiral molecules.
25. Understand optical activity and specific rotation.

26. Be familiar with and be able to use *R, S* specification of configuration.
27. Apply stereochemical principles to compounds with two or more chiral centres.
28. Understand the terms enantiomers, diastereoisomers and meso compounds.
29. Know about racemic mixtures and how they can be resolved.
30. Be familiar with the systematic nomenclature of alkyl halides.
31. Know how alkyl halides can be synthesised especially by electrophilic addition and nucleophilic substitution reactions.
32. Understand nucleophilic substitution of alkyl halides, including S_N1 and S_N2 reactions.
33. Know about biological nucleophilic substitution, Grignard reactions and elimination reactions.
34. Be able to apply systematic nomenclature to alcohols, ethers and phenols.
35. Know about hydrogen bonding, acidity and basicity of alcohols and phenols.
36. Be capable of designing suitable syntheses for alcohols and ethers.
37. Understand the reactions of alcohols particularly: elimination reactions (dehydration), substitution reactions (conversion to alkyl halides and ethers) and oxidation.
38. Know about thiols, their oxidation and biological importance.

Topic 3 Thermodynamics and Colligative Properties

3a: Thermodyanamics:

Thermodynamics is one of the unifying areas of science and engineering. It is based on two fundamental laws, simply called the first and second Laws of Thermodynamics. The second law is of particular importance as it determines the position of equilibrium of chemical and physical processes.

Thermochemistry

Thermochemistry aims to introduce students to the study of energy changes in chemical and physical processes and will focus on the First Law of Thermodynamics (The Law of Conservation of Energy). The importance of distinguishing between changes which occur at constant volume and constant pressure will be emphasised and the concept of enthalpy will be introduced.

The formulation of Hess's Law as an example of the First Law of Thermodynamics and the use of Hess' Law to calculate enthalpy changes will be discussed. The concept of enthalpy of formation will be introduced as a means of tabulating thermodynamic information and for calculating enthalpy changes. The importance of the Standard State in thermodynamics will also be discussed.

The measurement of enthalpy of combustion for hydrocarbons using a bomb calorimeter and the application of Hess' Law to obtain the enthalpy of formation of a hydrocarbon from its enthalpy of combustion will be discussed.

Equilibrium

This topic explores the driving force behind chemical and physical changes. The Semester 2 Topic "Equilibrium and Acid-Base Chemistry" involves a study of equilibrium from an empirical point of view. This topic looks at the fundamental reasons why changes occur.

The Second Law of Thermodynamics and the concept of entropy are shown as being central to this understanding. The free energy function is introduced and its application to the determination of equilibrium constants is discussed.

Assumed Background:

Only the general concepts required for the unit.

Text Books:

Chemistry by Moore, Stanitski and Jurs Chapters 6 and 18.

Some specific objectives for this topic:

After completing this topic you should know, understand or be able to do the following:

Thermochemistry (Moore, Stanitski and Jurs, Chapter 6)

1. Remember that the joule is the SI unit of energy but also be familiar with the calorie and the relationship between the Joule (J) and the calorie (cal).
2. List several kinds of energy (eg kinetic, potential, electrical) and to show that each type of energy has the same dimensions (J).
3. State the First Law of Thermodynamics in words.
4. Remember the following symbols and their significance: U, H, q, w, C, C_v, C_p, C_s, C_{sv}, C_{sp}, C_m, C_{mv}, C_{mp}, T, P, V, R, ΔH_f.

5. Remember the following terms and their significance in the thermodynamic context: open, closed and isolated systems, surroundings, isothermal and adiabatic processes, state of a system, state function, exo and endothermic, work, heat, temperature.

6. Understand the significance of the delta (Δ) notation eg ΔH

7. Remember the equations $w = P\Delta V$, $\Delta U = q + w$, $H = U + PV$, $\Delta H = \Delta U + \Delta(PV)$, $q_p = \Delta H = nC_{mp}\Delta T = mC_{sp}\Delta T$, $q_v = \Delta U = nC_{mv}\Delta T = mC_{sv}\Delta T$, $C_{sp} = C_{sv} + R$, and be able to apply them.

8. Understand the significance of the equation $dU = q + w$ in relation to the First Law.

9. Understand the significance of the term 'state function' and recognise that U is a state function but heat (q) and work (w) are not.

10. Recognise that the Law of Conservation of Energy and the First Law of Thermodynamics are identical.

11. Appreciate that U and C_V are constant volume parameters, while H and C_P are the corresponding constant pressure parameters.

12. Remember the equation ($H = U + PV$) defining Enthalpy, and the equation ($\Delta H = \Delta U + P\Delta V$) relating changes in Enthalpy at constant pressure, ΔH, with changes in Internal Energy ΔU.

13. Recognise the $P\Delta V$ term as a work term, and to be able to apply it under a given set of experimental conditions.

14. Derive the equations showing that ΔH and ΔU are the heat absorbed under constant pressure (q_P) and constant volume (q_V) conditions respectively.

15. Write down the equation ($C_{sp} = C_{sv} + R$) relating the two Heat Capacities.

16. Use the Heat Capacities to calculate ΔH and ΔU for the process of changing the temperature of a pure substance from T to T, and to recognise that knowledge of the temperature dependence of the Heat Capacities is important when performing such calculations.

17. Appreciate the meaning of exothermic (ΔH = -ve) and endothermic (ΔH = +ve) processes.

18. Remember the thermodynamic definition of Standard State at any temperature T refers to the state of the system at $P = 1.013 \times 10^5$ N m^{-2} (ie 1 atm).

19. Remember that every element in its most stable physical form under these Standard State conditions is defined as having zero Enthalpy of Formation.

20. Remember the meaning of the Standard Enthalpy of formation [ΔH_f^o].

21. Remember the meaning of the Standard Enthalpy of a chemical reaction [ΔH^o(react)].

22. Remember the meaning of the Standard Enthalpy of a phase change [eg ΔH^o(solid to liquid)].

23. Remember the meaning of the Standard Enthalpy of combustion [ΔH^o(comb)].

24. Calculate the Enthalpy change (ΔH) for any proposed chemical reaction by using Hess' Law and a given series of other chemical equations containing the proposed products and reactants, together with the corresponding Enthalpy data.

25. Use a table of tabulated Standard Enthalpies of formation to calculate ΔH for a reaction.
26. Be able to calculate the unknown Standard Enthalpy of formation of a pure substance using Hess' Law, an experimental Enthalpy of combustion for the same pure substance and tabulated Standard Enthalpies of formation.
27. Use the fact that H is a state function, to derive a relationship between ΔH, temperature and heat capacity (Kirchoff equation).
28. Calculate the Enthalpy change for a chemical process at one temperature, given the ΔH value at another temperature and a set of heat capacities.
29. Recognise that knowledge of the temperature dependence of the Heat Capacities is also important when performing these calculations.
30. Describe the basic constructional features of a calorimeter.
31. Outline the various steps used to calibrate a calorimeter (ie. to determine its heat capacity).
32. Calculate q for a given chemical or physical process occurring in a calorimeter from a set of experimental data.
33. Understand the difference between the bond energy and the average bond energy.

Thermodynamics and Equilibrium (Moore, Stanitski and Jurs, Chapter 18)

34. Explain the meaning of spontaneous change applied to chemical and physical processes.
35. Discuss the concept of entropy and its relationship to order in a system.
36. Know the meaning of standard molar entropy and standard reaction entropy.
37. Know why we can estimate the absolute entropy of a substance but not the absolute enthalpy.
38. Calculate the entropy change associated with a physical change.
39. Recognise that a spontaneous change is a function not only of the system but also of the surroundings.
40. Calculate the entropy change in the surroundings from the enthalpy change in the system.
41. Know the statement of the Second Law of Thermodynamics.
42. Write the equation defining free energy and free energy change.
43. Recognise that $\Delta G = 0$ for a system at equilibrium.
44. Know the equation which relates ΔG^o and the equilibrium constant.
45. From tables be able to calculate the entropy change and the free energy change for a physical or chemical process.

3b: Colligative Properties and Related Concepts:

The study of the equilibria between the phases (solid, liquid and gas) is important in many areas of science. The behaviour of pure substances and that of mixtures as a function of temperature, pressure and composition is relevant to such areas as fractional distillation, gas solubility and alloy formation. The behaviour of these systems

is governed by the phase rule and can be displayed on a phase diagram. The experimental establishment and interpretation of these diagrams will be discussed for a pure substance and for a binary mixture. The study of the properties of viscosity, surface tension, diffusion, boiling point elevation, freezing point depression, vapour pressure lowering, and osmotic pressure will be investigated and their relevance to everyday life explored.

Text Books:
Chemistry by Moore, Stanitski and Jurs Chapters 11 and 15.

Some specific objectives for this topic:
After completing this topic you should know, understand or be able to do the following:

1. State the phase rule.
2. Understand what is meant by degrees of freedom, phase and component in the statement of the phase rule.
3. Know how the vapour pressure of a pure substance changes with temperature.
4. Know how to determine the value of the enthalpy of vaporisation from vapour pressure/temperature data.
5. Draw the equilibrium phase diagram (P versus T) for a single pure substance, and to label the various phases present.
6. Understand the difference between the triple point and the normal melting point.
7. On the phase diagram for a pure substance label the normal melting point, normal boiling point, triple point and critical point.
8. Appreciate how melting and boiling points of a pure substances change with pressure.
9. Understand why the variation of melting point with pressure for water is unusual.
10. Appreciate how equilibrium phase diagrams for two component systems are established experimentally from cooling curves.
11. For a two component system, be able to interpret a cooling curve.
12. State and apply Raoult's Law.
13. State and apply Henry's Law.
14. Understand the concepts of viscosity, surface tension and diffusion, and be able to explain in chemical terms how they occur.
15. Understand the concepts of boiling point elevation, freezing point depression, vapour pressure lowering, and osmotic pressure, and be able to calculate the physical constants and variables associated with these concepts.

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Topic content:	individual topic lecturers (see page 4)	