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Introduction

This guide has been produced to assist you in your study of the first year chemistry unit KRA114 (Chemistry 1B). 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 objectives to check your progress. If you do not understand what is trying to be achieved or you are uncertain of the desired outcomes in any part of the unit consult your lecturer, demonstrator or unit coordinator.

Unit summary

Unit code	KRA114
Unit title	Chemistry 1B
Unit description	<p>This unit (along with Chemistry 1A in Semester 1) is the required prerequisite for students intending to major in Chemistry and for those intending to proceed to any second-year chemistry units.</p> <p>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:</p> <ul style="list-style-type: none">• 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	Prof Brian F Yates, Dr Michael G Gardiner and Dr Robert A Shellie
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 <i>handbook entry for alternative prerequisites, such as via bridging programs.</i>
Corequisites	None
Mutual exclusions	All other Semester 2 first year chemistry units
Assessment	Exams 60%, tests 10%, assignments 10%, laboratory 20%
Required texts	<ul style="list-style-type: none">• JW Moore, CL Stanitski and PC Jurs, <i>Chemistry: the Molecular Science</i>, 3rd edn• J McMurry, <i>Fundamentals of Organic Chemistry</i>, Brookes/Cole, 6th edn• DA Skoog, <i>Fundamentals of Analytical Chemistry</i>, 8th edn, Ch 30

- *Chemistry 1B Lecture Notes*, UTas (from UniPrint)
 - *Chemistry 1B 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	Tests, exams	Professional knowledge of chemical principles
Problem-solving skills	Assignments, lab sessions, tutorials,	Assignments, tests, exams	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 during 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 1st topic (Bio-Organic Chemistry), be familiar with the background material available in McMurry, Chapters 1-4

Details of teaching arrangements

Lectures	Bio-Organic Chemistry	Prof Brian F Yates	12L
	Coordination chemistry and Chemical Kinetics	Dr Michael G Gardiner	13L
	Equilibrium, Acid/Base Chemistry and Separation Techs. in Analytical Chem.	Dr Robert A Shellie	13L

Lecture times and location Mon 12:00, Wed 9:00 & Fri 2:10:
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 days During the study week at the end of Semester 2 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 15 of Semester 2. 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 of equipment.

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. **Do not** interpret this to mean that you can "skip" up to two experiments without a mark penalty receiving a mark penalty.

If you are absent for a genuine reason (for which a written excuse, such as a medical certificate, will be required). You must inform us as quickly as possible. 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 is 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 KRA113 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 summary 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.
14	July 13	Bio-Organic Chemistry (Topic 1) Brian Yates 12 lectures				Intro. to MyLO ***	
15	July 20				Expt 1	Topic 1	Topic 1
16	July 27				Expt 2	Topic 1	Topic 1
17	Aug 3				Expt 3	Topic 1	Topic 1
18	Aug 10	Coord Chem and Chemical Kinetics (Topic 2) Michael Gardiner 13 lectures				Topic 1	Topic 1
19	Aug 17					Topic 2	Topic 2
20	Aug 24				Mid-Semester Test		Topic 2
MID SEM. BREAK	Aug 31	Mid-Semester Break					
21	Sept 7	(Topic 2, con't)			Expt 4	Topic 2	Topic 2
22	Sept 14				Expt 5	Topic 2	Topic 2
23	Sept 21	Equilibrium, Acid/Base & Ext (Topic 3) Robert Shellie 13 lectures				Topic 3	Topic 3
24	Sept 28				Expt 6	Topic 3	Topic 3
25	Oct 5				Expt 7	Topic 3	Topic 3
26	Oct 12				Expt 8	Topic 3	Topic 3
STUDY WEEK	Oct 19	TUTORIAL DAY DURING THIS WEEK					

*** Introduction session for the MyLO assignments (only for students commencing 1st year chemistry in Semester 2). Venue: Chemistry Computer Lab (room 309).

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). Choose the tutorial time that fits your schedule (attend more than one if you want!). **All students commencing chemistry in Semester 2 must attend the Week 14 MyLO introduction tutorial at these times** (Chem. Computer Lab: room 309). Regular tutorials start in Week 15.

Semester 2 Week	Tuesday 9-10 in Lecture Theatre Chem329	Tuesday 10 - 11 in Lecture Theatre Chem329	Friday 10 - 11 in Lecture Theatre Chem329
14	<i>Intro to MyLO</i> ***	<i>Intro to MyLO</i> ***	<i>Intro to MyLO</i> ***
15	Prof Yates	Prof Yates	Prof Yates
16	Prof Yates	Prof Yates	Prof Yates
17	Prof Yates	Prof Yates	Prof Yates
18	Prof Yates	Prof Yates	Prof Yates
19	Dr Gardiner	Dr Gardiner	Dr Gardiner
20	Dr Gardiner	Dr Gardiner	Dr Gardiner
21	Dr Gardiner	Dr Gardiner	Dr Gardiner
22	Dr Gardiner	Dr Gardiner	Dr Gardiner
23	Dr Shellie	Dr Shellie	Dr Shellie
24	Dr Shellie	Dr Shellie	Dr Shellie
25	Dr Shellie	Dr Shellie	Dr Shellie
26	Dr Shellie	Dr Shellie	Dr Shellie

*** Introduction session for the MyLO assignments (only for students commencing 1st year chemistry in Semester 2). Venue: Chemistry Computer Lab (room 309)

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

Exam	3 hrs (18 questions)	60%
	In October/November university examination period, covering all the material covered in Semester 2 (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 20 in the normal lecture time and venue covering the work of Semester 2 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 on laboratory 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

Students that have not completed Chemistry 1A (KRA113) in Semester 1 are expected to attend a **compulsory** tutorial on the use of MyLO during the first week of semester. It is vital that you attend this session. This will be held in the chemistry computer laboratory (room 309) during the normal tutorial times.

Assignments

The assignment load required for Chemistry 1B consists of 12 weekly assignments completed via an Internet based approach using MyLO. These start in Week 15. In addition, two assignments are available from Week 14 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 15-26. 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 extensive 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 then 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.
- Further information on the use of this package will be given in a study guide issued at the MyLO tutorial (for students commencing mid-year in chemistry).
- The MyLO Web address (URL) is: <http://www.utas.edu.au/coursesonline/>

The schedule of assignments is shown below:

Sem. week	Date available	MyLO label	Staff member	Topic
14	July 13	Ass14_09_chem._revision	Dr Greg Dicoski	Training with MyLO/ chemistry refresher (<i>not assessed</i>)
14	July 13	Ass14_09_maths_skills	Dr Greg Dicoski	Maths Skills Quiz (<i>not assessed</i>)
15	July 20	Ass15_09_BFY	Prof Brian Yates	Aldehydes and Ketones
16	July 27	Ass16_09_BFY	Prof Brian Yates	Carb. Acids and Derivs
17	Aug 3	Ass17_09_BFY	Prof Brian Yates	Amines
18	Aug 10	Ass18_09_BFY	Prof Brian Yates	Carbohydrates
19	Aug 17	Ass19_09_MGG	Dr Michael Gardiner	Coordination Chem. 1
20	Aug 24	Ass20_09_MGG	Dr Michael Gardiner	Coordination Chem. 2
21	Sept 7	Ass21_09_MGG	Dr Michael Gardiner	Chemical Kinetics 1
22	Sept 14	Ass22_09_MGG	Dr Michael Gardiner	Chemical Kinetics 2
23	Sept 21	Ass23_09_RAS	Dr Robert Shellie	Equilibrium
24	Sept 28	Ass24_09_RAS	Dr Robert Shellie	Equil/Acid/Base Chem.
25	Oct 5	Ass25_09_RAS	Dr Robert Shellie	Acid/Base Chemistry
26	Oct 12	Ass26_09_RAS	Dr Robert Shellie	Extraction Techniques

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 which 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 lectures – Coord Chem and Chem Kinetics	6226 2404 Michael.Gardiner@utas.edu.au (room 301)
Dr Emily Hilder		Laboratory Coordinator	6226 7670 Emily.Hilder@utas.edu.au (room 410)
Dr Greg Dicoski		MyLO Coordinator	6226 2166 Greg.Dicoski@utas.edu.au (room 403)
Dr Robert Shellie		lectures – Equil, Acid/Base Chem. and Ext. Tech.	6226 7656 Robert.Shellie@utas.edu.au (room 2005)
Prof Brian Yates		lectures – Bio-Organic Chem.	6226 2167 Brian.Yates@utas.edu.au (room 204)
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)

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	http://www.utas.edu.au/units/KRA114/

Unit content

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

Topic 1 Bio-organic Chemistry

In the first part of this topic, the structures and reactions of several organic functional groups, which have important functions in biological chemistry, will be described. The main emphasis will be on explaining the mechanisms whereby these organic compounds react. Classes of compounds described will include aldehydes and ketones, carboxylic acids and derivatives, and amines. The second part of this topic will provide an introduction to some of the organic compounds containing these functional groups that are of fundamental importance to living organisms. Topics include lipids, carbohydrates, amino acids and proteins.

Assumed Background:

The structure, bonding and simple reactions of organic compounds as described in McMurry, Chapters 1-4.

Textbook:

Fundamentals of Organic Chemistry by McMurry.

Topic Outline:

1. Aldehydes and ketones (Ch 9)

Structure of the carbonyl group, nomenclature, synthesis, reactions – oxidation of aldehydes and nucleophilic additions, keto-enol tautomerism.

2. Carboxylic acids and derivatives (Ch 10)

Nomenclature, properties – acidity of carboxylic acids, synthesis of acids, nucleophilic acyl substitution reactions, inter-relationships among carboxylic acids and derivatives, step growth polymerisation.

3. Amines (Ch 12)

Nomenclature, basicities of amines and amides, synthesis, reactions – amines as nucleophiles, heterocyclic amines.

4. Lipids: fats and oils (Ch 16)

Structure and occurrence, hydrogenation, hydrolysis (saponification), phospholipids and steroids.

5. Carbohydrates (Ch 14)

Monosaccharides – aldoses and ketoses, cyclic structure and hemiacetals, reactions – glycoside formation, reduction and oxidation, disaccharides – cellobiose, maltose, sucrose, polysaccharides – cellulose and starch.

6. Amino acids, peptides and proteins (Ch 15)

Amino acids – structures and acid-base properties, reactions, peptides and proteins – the peptide bond, primary structure and its determination, secondary, tertiary and quaternary structure.

Some specific objectives for this topic:

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

1. Utilise systematic nomenclature for aldehydes and ketones.
2. Understand the structure of the carbonyl group.
3. Know about syntheses of aldehydes and ketones.
4. Be able to use reactions of carbonyl compounds, particularly nucleophilic additions and oxidation of aldehydes.
5. Recognise when keto-enol tautomerism may occur.
6. Be familiar with systematic nomenclature of carboxylic acids and derivatives.
7. Know the reason for acidity of carboxylic acids.
8. Be able to design syntheses of acids.
9. Be familiar with nucleophilic acyl substitution reactions.
10. Know the inter-relationships among carboxylic acids and derivatives.
11. Be able to describe step growth polymerisation.
12. Be familiar with the nomenclature of amines.
13. Know about basicities of amines and amides.
14. Be able to design syntheses leading to amines.
15. Know how amines react, particularly as nucleophiles.
16. Be able to recognise heterocyclic amines.
17. Know the general structures and occurrence of the lipid classes.
18. Understand the reactions of triglycerides particularly hydrolysis (saponification), hydrogenation and hydrogenolysis.
19. Be able to recognise phospholipids and steroids.
20. Be familiar with monosaccharides, especially aldoses and ketoses, stereochemical specification and representations, cyclic structures and hemiacetals.
21. Know how monosaccharides react, particularly glycoside formation, reduction and oxidation.
22. Be familiar with the structures and reactions of the disaccharides cellobiose, maltose and sucrose.
23. Be able to recognise a polysaccharide and know the principles of bonding in cellulose and starch.
24. Know the general formula for the natural amino acids.
25. Be able to apply stereochemical principles to the chiral amino acids.
26. Understand the ionic structures and acid-base properties of amino acids.
27. Be familiar with the joining together of amino acids via the peptide bond.
28. Know about the primary structure of peptides and proteins and its determination.
29. Understand what is meant by secondary, tertiary and quaternary structure.

Topic 2 Coordination Chemistry and Chemical Kinetics

The three sections in this topic are not closely related. Separate outlines for each follow.

Many applications of chemistry involve compounds that contain metals. The properties of the metal impart considerable effects on the use of their, so-called, **coordination complexes** in applications such as catalysis, materials science, pharmaceutical and biological processes. To predict to some extent the action of metal complexes in these applications, a general understanding of transition metal coordination chemistry is needed and some basic concepts need to be understood.

Chemical kinetics is concerned with reaction rates (and reaction mechanisms). Knowing how fast a chemical change will occur can be extremely important, e.g., how quickly will a medicine act, or cement harden, or an environmental spill degrade in summer or winter. The rates of reactions can often be manipulated to maximise the yield of a desired product or to slow down unwanted reactions.

Assumed Background:

Only the general concepts required for the unit.

Textbook:

Chemistry by Moore, Stanitski and Jurs, Chapters 22 (all except 22.2-22.5), 13, 11.

Topic Outline (Coordination Chemistry):

1. The basics of transition metals: (Chapter 22.1 pg 1063-1068)

Transition metals are unique from other metals in the periodic table. They have many different physical properties as well as reactivities compared to other metals. Some of these will be outlined as a precursor to a discussion of the coordination chemistry of transition metals.

2. What is a coordination compound?: (Chapter 22.6, pg 1081-1083)

This is a very important question which in itself requires the explanation of some terms used in association with coordination chemistry. Basic effects that come into play in coordination chemistry are also explained.

3. What are the complexes called?: (Chapter 22.6 pg 1083-1085)

Once some basic definitions and concepts are explained, the naming of coordination complexes becomes quite simple. There are just a few rules to learn.

4. Shapes and isomers: (Chapter 22.6, pg 1085-1093)

Similar to organic chemistry, the shape of a molecule is related to the orbitals. This is explained. Like organic compounds, coordination complexes also can exist as isomers and the different types will be described.

5. Crystal Field Theory: (Chapter 22.7, pg 1093-1099)

What determines the shape of coordination compounds, the colour of the compounds and the magnetic properties of the compounds? Introductory crystal field theory will help explain these properties.

Some specific objectives for this topic (coordination chemistry):

After completing this topic you should be able to:

1. Write the electronic configuration of transition metals and their ions.
2. Understand the idea of multiple oxidation states.
3. Identify what *ligands* are present in a coordination complex and identify their *denticity*.
4. Be able to identify the *donor atom(s)* of a ligand.
5. Give the *coordination number* for a coordination complex.
6. Calculation the *oxidation number* for the metal in a coordination complex.
7. Calculation the overall charge of a complex.
8. Write the name of a coordination complex from its formula and *vice versa*.
9. Draw the five *d-orbitals*.
10. Draw octahedral, tetrahedral and square planar geometries.
11. Be able to identify and draw *constitutional isomers* (coordination and linkage isomers) and *stereoisomers* (geometric and optical isomers) of coordination complexes.
12. Draw the *orbital diagram* for octahedral, tetrahedral and square planar geometries.
13. Understand and draw the orbital diagrams for *high spin* and *low spin* metals.
14. Define *crystal field splitting* and understand how a ligand's position in the *Spectrochemical Series* affects this.
15. Understand how the crystal field splitting affects the colour and magnetic properties of coordination complexes.
16. Know some applications of coordination complexes.

Some specific objectives for this topic (Chemical Kinetics):

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

1. Know that for a chemical reaction the rate of consumption of reactants and formation of products varies with reactant concentration, and that the unit of a reactions rate are always "[units]/time".
2. Understand the meanings of initial, instantaneous and average reactions rates and be able to calculate these numerically and graphically.
3. Know that the rate equation (law) is experimentally determined and that it expresses the rate of reaction as a function of concentration of reactants and products.
4. Be able to clearly distinguish between the rate of a reaction and the rate constant for that reaction.
5. Understand that rate constant (*k*) in a rate equation describing a chemical reaction is characteristic of that reaction and is temperature dependent and has units that depend on the order of the reaction.
6. Be familiar with the term "order of reaction" and be able to calculate the overall reaction order and the order with respect to each of the species in the rate equation.
7. Be able to determine the order of the reaction by the initial rate method.

8. Be able to use the integrated rate equations for first and second order reactions.
9. Be able to calculate the rate constant for first and second order reactions.
10. Be familiar with the meaning of reaction half-lives and be able to solve problems relating to reaction half-lives for first order reactions.
11. Be familiar with the collision model as the basis for the physical understanding of temperature effects in chemical kinetics.
12. Be familiar with the physical meanings of the frequency factor and the activation energy for a reaction as a basis to the Arrhenius Equation describing reaction temperature dependences.
13. Be familiar with the concept "reaction pathway" describing the energy profile of reaction mechanisms and associated terms, such as transition state (activated complex) and reaction intermediate.
14. Be familiar with the fact that forward and reverse reactions still take place when equilibrium is established. Under these conditions the rates of the forward and reverse reactions are equal.
15. Be familiar with the concept of reaction mechanisms as describing the actual ways in which a reaction occurs.
16. Be familiar with an elementary reaction step being the simplest process of a reaction and that elementary reactions are single-step reactions. Multistep, or complex reactions take place by a series of elementary steps which sum to the overall reaction.
17. Be familiar with the meaning of the term reaction molecularity: uni-, bi- or termolecular.
18. Understand why termolecular reactions are very rare and higher molecularity is never observed.
19. Be able to recognise and sketch the qualitative energy profile features of single- and multistep reactions.
20. Know that the slowest step in a complex reaction is termed the rate determining step.
21. Have knowledge about the basis of chemical catalysis and how it affects the energy profile of a reaction, and hence the various parameters of the chemical kinetics such as the activation barrier, reaction rate and rate constant.
22. Be aware of some of the areas in which chemical catalysis impacts on our lives.

Topic 3 Equilibrium, Acid/Base Chemistry and Extraction Techniques in Analytical Chemistry

The existence of chemical **equilibrium** means that a chemical reaction does not go to completion - reactants and products coexist in the system. This sub-discipline of chemistry is essential to our understanding of reactions in modern technology, the environment and our own human biology and is the reason why chemistry is central to other areas of science.

This topic will build on the principles that you have learnt in chemical kinetics to understand how changes in reaction variables such as temperature, pressure and concentration affect the position of equilibrium and how it is possible to promote the formation of the desired product by controlling these variables.

In studying chemical equilibria of gas phase reactions we will learn how to describe the dynamic equilibria reached in chemical reactions and how to predict and calculate the composition of the reaction mixture when equilibrium has been reached.

A study of chemical equilibria in aqueous solution will concentrate on solubility equilibria and equilibria involving acids and bases which are an important part of analytical/biological/industrial chemistry. The theory behind precipitation and sparingly soluble salts will be examined. This will include considering will a precipitate form and the influence of common ions and other ions on equilibrium position.

Calculation of **acid/base equilibrium** constants and the concentration of species in solution will be a vital aspect of the topic. The pH of solutions containing strong and weak acids and bases will be studied in terms of equilibria. The concept of buffer solutions will be examined, and the applications of this theory applied to investigating acid base titrations, and indicators.

The **Extraction Techniques** section will commence with a brief introduction to methods employed in the separation of components in complex mixtures. The topic builds on the concept of equilibrium and acid-base chemistry, and illustrates an important application of this branch of chemistry.

Solvent extraction, which is a single stage separation process, is the "simplest" and most commonly used form of separation technique and will be covered in some detail. The efficient partitioning of sample components between different phases is fundamental to all extraction/separation methods and a basic discussion of partition equilibria as applied to solvent extraction will be given in this part of the topic.

Assumed Background:

Only the general concepts required for the unit.

Text books:

Chemistry by Moore, Stanitski and Jurs, Chapters 15-17.

Some Specific Objectives for this topic:

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

Chemical Equilibrium

1. Be able to describe chemical equilibria.
2. Understand the significance of the equilibrium constant.
3. Understand and be able to predict how equilibria are modified by reaction parameters.
4. Be proficient at calculations involving chemical equilibria including: equilibrium constants, reaction quotients and the composition of mixtures when equilibrium is reached.

5. Understand the concept of, and perform calculations involving, precipitation, sparingly soluble salts, will a precipitate form, etc.
6. Understand the concepts of: competing reactions, the common ion effect and the salt effect.

Acid/Base Chemistry

1. Be familiar with various definitions of acids and bases.
2. Be familiar with the equilibrium constants used in the description of dilute solutions of acids and bases.
3. Be proficient in acid-base calculations, calculations of equilibrium concentrations of solution species and in the calculation of pH.
4. Be proficient in calculations involving the hydrolysis of salts and involving the effect of added common ion on the concentration of solution species.
5. Be familiar with the use and purpose of buffers.
6. Undertake calculations involving buffered solutions including calculation of the pH of buffer mixtures and their buffer capacities.
7. Be able to describe and calculate the effects associated with dilution of buffer mixtures.
8. Be able to interpret and sketch pH curves.
9. Be familiar with the selection and application of indicators.
10. Be able to calculate and plot acid-base titrations curves for various acids and bases.

Extraction Techniques

1. Be familiar with the various processes of separating sample components and understand the role of separation methods in analytical chemistry, their purpose and wide applicability.
2. Be familiar with the principles of solvent extraction, the simplest separation method.
3. Understand simple partition equilibria as applied to solvent extraction.
4. Understand the difference between the Partition Coefficient (K_p) and the Distribution Ratio (D).
5. Be able to derive simple expressions relating D with K_p and other equilibrium constants in simple extraction processes.
6. Be able to undertake calculations involving extraction processes for single and multiple extractions.
7. Be able to differentiate between extraction efficiency and separation efficiency and be familiar with calculations demonstrating the difference.
8. Be familiar with the effect of pH on extraction and separation processes.

General queries:	Dr Michael Gardiner	Rm 301
Lab classes:	Dr Emily Hilder	Rm 410
MyLO:	Dr Greg Dicoski	Rm 403
Topic content:	individual topic lecturers (see page 4)	