

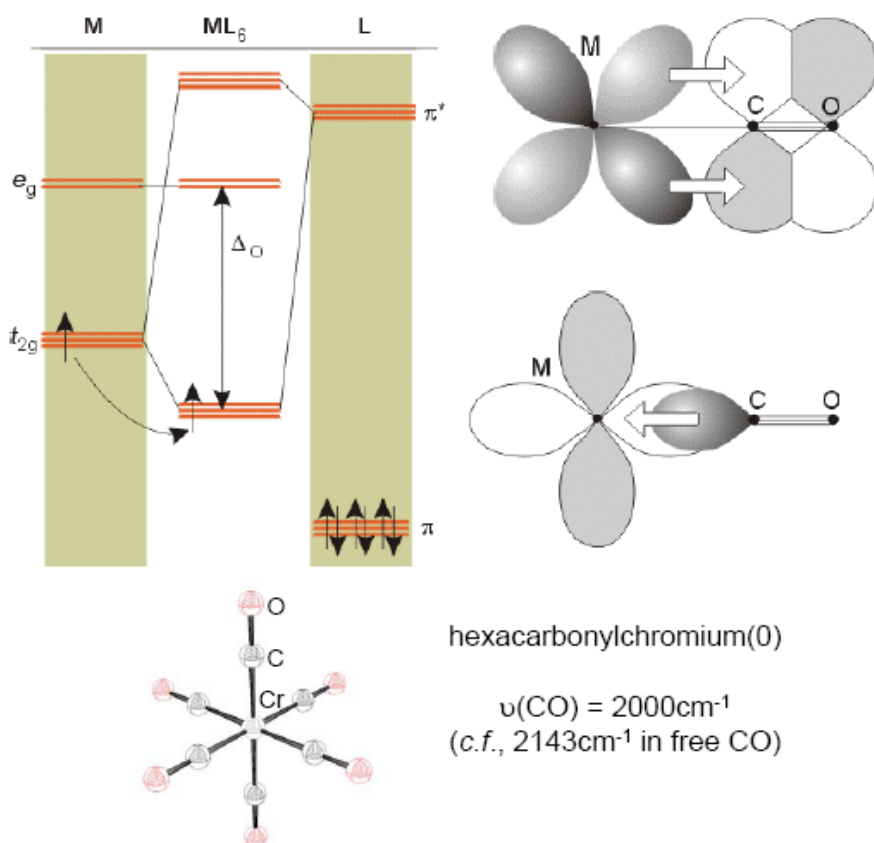


UNIVERSITY  
OF TASMANIA

**School of Chemistry**  
Faculty of Science, Engineering & Technology

# KRA225: Chemistry 2B Inorganic and Physical

## Unit Outline, 2009



The latest version of this unit outline is available on the web at  
<http://www.utas.edu.au/chem/chem2.htm>

(This version updated: 08/07/09)

Unit coordinator:

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## Unit summary

|                          |   |
|--------------------------|---|
| <b>Unit code</b>         | KRA225 (replacing parts of KRA210, KRA216/217)  |
| <b>Unit title</b>        | Chemistry 2B Inorganic and Physical (prev. titled "Inorganic Chemistry and Reaction Mechanisms" with the same code)   |
| <b>Unit description</b>  | Builds on KRA113/114 or KRA101/102, and consolidates the theoretical and practical framework required by students who intend to major in chemistry or who need additional chemistry to support their studies in other science areas. The inorganic chemistry topic covers the synthesis and properties of inorganic and organometallic compounds (especially transition metal coordination complexes and organometallic chemistry of the main group metals), with an underlying emphasis on modern techniques used to determine chemical structures and contemporary properties of inorganic compounds. Reaction mechanisms are studied in depth through both physical and computational chemistry topics that provide the necessary background in the principles and applications of kinetics, molecular orbital theory and molecular modelling. The application of electrochemistry to the determination of the fundamental thermodynamic parameters of entropy, Gibbs free energy, enthalpy and equilibrium constants is also studied. It also covers the movement of ions in solution, strong and weak electrolytes, how ions carry current and contribute to conductivity, as well as the effective concentration of species in solution. The laboratory program reinforces concepts introduced in lectures and gives students experience in good laboratory practice. |
| <b>Special Notes</b>     | This unit, together with KRA223 and KRA224, comprise the three 200-level units leading to a major in Chemistry. The Royal Australian Chemical Institute recommends that all three of these units are completed in order to join the institute as a member. This unit is the suggested Semester 2 200 level unit serving as a prerequisite for the synthesis related 300 units KRA333, KRA334 and KRA335, and it will aid aspects of KRA332 (KRA223 is the alternative 200-level prerequisite unit offered in Semester 2). Students who would like to do this unit but have a timetable problem with either lectures, tutorials or laboratory work should consult the Head of School or unit coordinator.  |
| <b>Teaching staff</b>    | Dr Michael Gardiner, Dr Trevor Lewis, Prof Brian Yates  |
| <b>Campus &amp; mode</b> | Hobart, internal  |
| <b>Unit weight</b>       | 12.5%   |
| <b>Teaching pattern</b>  | Semester 2: 26 lectures, 13 tutorials, 12x4 hours lab   |
| <b>Prerequisites</b>     | (KRA101 and KRA102) or (KRA113 or KRA114) or equivalent   |
| <b>Corequisites</b>      | none  |
| <b>Mutual exclusions</b> | none  |

|                            |  |
|----------------------------|--|
| <b>Assessment</b>          | Exams 70%, assignments 5%, laboratory 25%  |
| <b>Required texts, etc</b> | Atkins PW, et al, Inorganic Chemistry, ISBN 0199264635<br>Atkins PW, Physical Chemistry, ISBN 0198792859<br><i>KRA225 Lecture Notes</i> (available from UniPrint)<br><i>KRA225 Laboratory Manual</i> (available from UniPrint) |
| <b>Recommended texts</b>   | as specified by individual lecturers   |

## Learning outcomes

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

- use a software package to create, manipulate and visualise models of simple molecules
- apply qualitative molecular orbital theory to simple chemical structures
- an understanding of some of the principles of solution electrochemistry: how and why ions move in solution and how this contributes to their ability to conduct electricity, the conductivities of strong and weak electrolyte solutions, and activity and activity coefficients as measures of effective concentration in solution
- use electrochemical data to determine solubility constants, Gibbs free energy, entropy and equilibrium constants in solution
- an understanding of the principles of chemical kinetics
- experimentally determine the rate of reaction and its dependence on parameters such as concentration, temperature and catalysis
- use kinetics to understand the mechanism of a chemical reaction, including the number of steps involved and the nature of the intermediates
- further knowledge of transition metal coordination chemistry beyond that introduced in 1<sup>st</sup> year chemistry in the areas of structure, bonding, reactivity
- knowledge of the structure, bonding and reactivity of s- and p-block metal coordination and organometallic complexes
- apply your knowledge to understanding and designing applications of transition metal coordination and main group organometallic complexes, with an emphasis on synthetic applications
- developed experimental skills allowing (i) the synthesis of many of the classes of complexes described above, and, (ii) observation and analysis of many of the physical and reactivity properties of these complexes. In addition, some experience in experimental and interpretive skills not covered in lecture topics will be obtained through the laboratory course

## Details of teaching arrangements

|                 |                           |                       |     |
|-----------------|---------------------------|-----------------------|-----|
| <b>Lectures</b> | Solution Electrochemistry | Dr Trevor W. Lewis    | 7L  |
|                 | Computational Chemistry   | Prof Brian F Yates    | 7L  |
|                 | Inorganic Chemistry       | Dr Michael G Gardiner | 12L |

**Lecture times** Tues 11:00-11:50, Friday 12:00-12:50

**Lecture location** Lecture Theatre Chem329

**Lecture schedule** See last page

**Tutorials** Tues 10:00-10.50, Lecture Theatre Chem327. 13 tutorials will be held during the semester. Introductory laboratory tutorials will be held during weeks 14 and 21 to explain some of the safety and/or administrative procedural aspects of both sections of the laboratory course.

The ChemClub Room (room 107) 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.

**Seminars** We invite you to attend the School of Chemistry seminars (Wednesday 12 noon in Lecture Theatre Chem329). You will likely find them useful to hear about the research activities of the School and research conducted in other institutions, as these are normally visitor and research student talks. The topics are advertised in the foyer of the Chemistry Building (speakers are normally instructed to pitch the level of the talk with the assumption that undergraduate students are in the audience).

**Study day** A study day will be held in the Chemistry Building during the Semester 2 study week. This will include a BBQ and tutorials to focus on past examination papers in the unit.

## Laboratory course

Four hours a week, chosen from Thursday 9 am-1 pm, Thursday 2 pm-6 pm and Friday 2 pm-6 pm, for 12 weeks in the Level 3 teaching laboratory (room 310).

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](http://www.admin.utas.edu.au/hr/ohs/pol_proc/ohs.pdf).

Occupational health and safety will be emphasised as part of the lab course. Before attending the first session, students are expected to have a laboratory coat, a pair of safety glasses or goggles, a laboratory record book and a laboratory manual, which describes the laboratory course in detail. The laboratory manual should be obtained from UniPrint, and a suitable record book is a *Collins 3880 Account Book*. The laboratory manual explains the fine system in place to recover costs for breakages and lost equipment.

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 during the first semester that you study a 200-level Chemistry unit*. **If you have not done this already in Semester 1, this course will be conducted as part of your laboratory course in this unit, and MUST be completed before you commence in the laboratory (at the latest, by week 15)**. This MyLO based module will provide you with a good appreciation of how to assess and then minimise the risks associated with working with chemicals. In order to satisfy the requirements for this part of the laboratory program you must score at least 16 out of 20 for the quiz.

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

## 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/learndev/>.

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**

**Exams** End-of-Semester exam, 3 hrs duration  
Questions are to be answered in the supplied examination booklets (and graph paper if required). No other written material will be assessed. If you are offered a choice of questions (say, requiring only 4 answers out of 5 possible questions), if you answer all the questions then only the first required number of answers (in the order they are presented by the student) will be marked. Answers to multipart questions will be dealt with the same way.

**Assignments** In order to provide opportunity for continuous assessment and feedback to students, a number of assignments will be issued (release dates and hand-in dates are to be advised by the topic lecturer. The marks of each lecturer will be scaled according to the proportion of lectures in the unit. The total assignment mark will be 5% of the total for the unit.

**Laboratory** Your final laboratory mark will be based on your performance in the lab, the quality of your chemical preparations and/or quantitative analyses, and your reports. Due dates for your reports will be given in the lab manual.

## **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 70% of the experiments in each of the two laboratory sections.

## **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 reports**

Lecturers and lab coordinators will provide details of when and where assignments and reports are due to be submitted. A signed cover sheet is required for every assignment and prac report (see the statement on plagiarism in this handout). The cover sheets will be available from the lecturer or the lab, respectively, or from [www.utas.edu.au/plagiarism](http://www.utas.edu.au/plagiarism)).

An electronic version of most your laboratory reports (word file: excluding spectra, lab diary, other attachments etc) must be submitted through MyLO along with the full hard copy of the reports for the purpose of examining with the plagiarism detection software *TurnItIn* (<http://www.utas.edu.au/tl/supporting/academicintegrity/software.html>). This software

cross-references the reports with previously submitted laboratory reports, web-based material, textbooks and the scientific literature for correct referencing/copying from previously submitted work. Failure to submit the final version of your laboratory report to *TurnItIn* will result in no marks being awarded for the relevant laboratory reports.

*Nexus*: journal of undergraduate science, engineering, and technology is published annually and contains the work of undergraduates. This unit contains assignments that are suitable for submission to the journal. For more information, ask your lecturer, and see <http://www.utas.edu.au/scieng/nexus>.

## 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 topic lecturer (for assignments) or the laboratory coordinator (for laboratory reports) as soon as practicable. Students without a medical certificate for absence will be assumed to have scored zero for the experiments/assignments not submitted.

## Penalties

A penalty of 10% of the actual mark will be imposed for each **working day** that an assignment or laboratory report is late. For example, if a student submits an assignment 3 days late and the work is assessed at 70% (without penalty), the mark would then be adjusted to  $70 - (3 \times 0.1 \times 70) = 49\%$ . **Late penalties for lab reports refer to both the hard copy and the *TurnItIn* electronic submission. *TurnItIn* submissions will close off 10 days after the deadline for lab reports.**

## 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).

## Academic referencing

In your written work you will need to support your ideas by referring to scholarly literature, works of art and/or inventions. It is important that you understand how to correctly refer to the work of others and maintain academic integrity.

Failure to appropriately acknowledge the ideas of others constitutes academic dishonesty (plagiarism), a matter considered by the University of Tasmania as a serious offence.

The appropriate referencing style for this unit is that used by either the *Australian Journal of Chemistry* or the *Journal of the American Chemical Society*.

## 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 and referencing guidelines, see <http://www.utas.edu.au/plagiarism/>.

Each time that you submit an assignment or laboratory report you are required to accompany it with a signed declaration that all the material 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 and the overall unit will be evaluated towards the end of Semester 2. As a result of previous SETL feedback we have, for example, introduced a timetabled regular tutorial slots and reorganised the laboratory experiments. 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.

## 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 is 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](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.

## Electronic resources

School of Chemistry home page  
School of Chemistry safety page  
University's MyLO site  
University Handbook entry  
SciFinder Scholar

<http://www.utas.edu.au/chem>  
<http://www.utas.edu.au/chem/chemsafety.htm>  
<http://www.utas.edu.au/coursesonline/>  
<http://www.utas.edu.au/units/KRA225>  
access available on a new web-based interface. See the library database catalogue for details.

## Staff contacts and responsibilities

Enquiries regarding the course should be directed to the unit coordinator in the first instance. However, students are welcome to discuss particular problems with the Head of School, Prof Brian Yates (Brian.Yates@utas.edu.au). There is also a "suggestion box" available in the foyer of the chemistry building for constructive, confidential comments.

| Staff member        | room | responsibilities                         | Contact                                   |
|---------------------|------|--|---|
| Dr Michael Gardiner | 301  | Unit coordinator<br>lectures – inorganic | 6226 2404<br>Michael.Gardiner@utas.edu.au |
| Dr Trevor Lewis*    | 325* | lectures – solution<br>electrochemistry  | 6226 2169*<br>Trevor.Lewis@utas.edu.au    |
| Prof Brian Yates    | 204  | lectures – comput. chem.                 | 6226 2167<br>Brian.Yates@utas.edu.au      |
| Mr Graham Meredith  | 313  | laboratory support                       | 6226 2168<br>Graham.Meredith@utas.edu.au  |

\* when in Launceston: Science Building, room 27-336, tel: 6324 3826

## Unit Schedule

(white = scheduled event, dark grey = holiday)

| Week       | Starting   | Lectures                    |                         | Tutorials                | Laboratory<br>Thursday<br>am/pm and<br>Friday pm |
|------------|------------|-----------------------------|-------------------------|--------------------------|--|
|            |            | Tuesday<br>11.00 – 11.50    | Friday<br>12.00 – 12.50 | Tuesday<br>10.00 – 10.50 |  |
| 14         | 13 July    | TWL                         | BFY                     | lab tut – BFY            | Physical<br>Chemistry<br><br>Weeks 14-19         |
| 15         | 20 July    | TWL                         | BFY                     | TWL                      |  |
| 16         | 27 July    | TWL                         | BFY                     | BFY*                     |  |
| 17         | 3 August   | TWL                         | BFY                     | TWL                      |  |
| 18         | 10 August  | TWL                         | BFY                     | BFY*                     |  |
| 19         | 17 August  | TWL                         | BFY                     | TWL                      |  |
| 20         | 24 August  | TWL                         | BFY                     | BFY                      |  |
|            | 31 August  | Mid-Semester Break          |                         |                          |  |
| 21         | 7 Sept.    | MGG                         | MGG                     | lab tut – MGG*           | Inorganic<br>Chemistry<br><br>Weeks 20-25        |
| 22         | 14 Sept.   | MGG                         | MGG                     | MGG*                     |  |
| 23         | 21 Sept.   | MGG                         | MGG                     | MGG                      |  |
| 24         | 28 Sept.   | MGG                         | MGG                     | MGG                      |  |
| 25         | 5 October  | MGG                         | MGG                     | MGG                      |  |
| 26         | 12 October | MGG                         | MGG                     | MGG                      |  |
| Study week | 19 October | a study day during the week |                         |                          |  |

\* special time to be determined in consultation at a later date