UNSW Course Outline

CHEM1821 Engineering Chemistry 1B - 2024

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General Course Information

Course Code : CHEM1821
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Chemistry
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course further develops the introduction to the engineering aspects of chemistry started in CHEM1811. The course explores organic and inorganic chemistry through the investigation of topics such as kinetics, control of reactions, structure determination, stereochemistry, main

group chemistry, transition metal chemistry, and the chemistry of carbon-containing compounds.

The target audience for this course is students who need a strong chemistry basis that will be applied in areas such as engineering and there will be an emphasis on the engineering applications of chemistry in the petrochemical industry, environmental chemistry, and renewable energies.

The theoretical content of the course is delivered through a combination of online lessons, workshops and lectures with problem solving skills developed in weekly group-based tutorial classes. Theory is combined with the practical aspects of chemistry in weekly laboratory classes. There is typically 8 contact hours per week (or 9 for weeks containing and in-term test) plus a guide that you should spend an hour of independent study for each contact hour.

The syllabus is divided into “threshold” and “mastery” topics (50:50). The “threshold” topics will be continuously assessed throughout semester and the mastery content primarily assessed in the final exam.

Course Aims

The aim of this course is to provide a sound understanding of the principles underlying modern chemistry and their application to chemical engineering supported by laboratory work, which also prepares a student for further studies in (chemical) engineering.

The course introduces a range of topics in chemistry and demonstrates the broader context of chemistry within engineering disciplines. Specifically, topics covered include kinetics, energy and mass balance, stereochemistry, structure determination and basic inorganic and organic chemistry.

The laboratory component aims to instill an appreciation of safe working practices in a chemistry laboratory and laboratory skills widely used in chemistry and chemistry-related laboratories.

Relationship to Other Courses

The school has multiple courses that satisfy the second half of level one chemistry:

- CHEM1021 (Chemistry 1B) this course is available in T1, T2 and T3
- CHEM1041 (Higher Chemistry 1B) this course is available in T2 only.
- CHEM1821 (Engineering Chemistry 1B) this course is available in T2 only.

These courses cover very similar content, with similar assessment tasks (tests, labs and exam) and assume the knowledge from CHEM1A (CHEM1011, CHEM1031 or CHEM1811), however CHEM1821 is more focused on engineering and includes content which is more applicable for engineering.

Prerequisite and Assumed Knowledge

CHEM1811 (Engineering Chemistry 1B) is a prerequisite for this course. All content covered in CHEM1811 is assumed knowledge for this course.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Describe the mechanisms of simple organic and inorganic reaction procedures and predict the products that are formed.
CLO2 : Apply the language of chemistry to the naming and representation of the stereochemistry of chemical substances and describe methods that can be used to confirm these chemical structures. (e.g. mass spectrometry, infrared spectroscopy, UV-visible spectroscopy, nuclear magnetic resonance spectroscopy).
CLO3 : Describe the kinetics of chemical processes, contrast the outcomes predicted by thermodynamics and kinetics, and analyse reactions in kinetic terms.
CLO4 : Analyse problems and prepare calculations to give estimates of chemical and physical quantities (such as mass balance and energy balance), for chemical engineering processes.
CLO5 : Work safely in a laboratory to manipulate apparatus, perform quantitative and qualitative chemical analysis, synthesize compounds, separate mixtures of compounds, evaluate the accuracy and precision of measurements, and to interpret results and observations.

Course Learning Outcomes	Assessment Item
CLO1 : Describe the mechanisms of simple organic and inorganic reaction procedures and predict the products that are formed.	• Weekly Quizzes • Threshold topic tests • Final examination
CLO2 : Apply the language of chemistry to the naming and representation of the stereochemistry of chemical substances and describe methods that can be used to confirm these chemical structures. (e.g. mass spectrometry, infrared spectroscopy, UV-visible spectroscopy, nuclear magnetic resonance spectroscopy).	• Weekly Quizzes • Threshold topic tests • Final examination
CLO3 : Describe the kinetics of chemical processes, contrast the outcomes predicted by thermodynamics and kinetics, and analyse reactions in kinetic terms.	• Weekly Quizzes • Threshold topic tests • Final examination
CLO4 : Analyse problems and prepare calculations to give estimates of chemical and physical quantities (such as mass balance and energy balance), for chemical engineering processes.	• Weekly Quizzes • Threshold topic tests • Final examination
CLO5 : Work safely in a laboratory to manipulate apparatus, perform quantitative and qualitative chemical analysis, synthesize compounds, separate mixtures of compounds, evaluate the accuracy and precision of measurements, and to interpret results and observations.	• Laboratory work

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Learning and Teaching in this course

The learning and teaching activities in this course consist of multiple teaching methods and modes of instruction which are delivered through a blended approach including Lectures, Tutorials, and Laboratories.

This course has been designed to engage students in learning by contextualising the material to students' prior experiences and knowledge. In addition, course content will be supplemented with interesting examples from research and industry. The laboratory component of this course will enable students to develop a proficiency in core chemistry laboratory skills while engaging in challenging and interesting laboratory practicals. In addition, this component of the course will contribute to the development of the students' higher-order analytical skills, while providing opportunity for cooperative learning with their peers

How this course works

We know that chemistry can be a conceptually challenging topic to study. We want each and everyone of our students to succeed and to gain valuable skills and knowledge. For these reasons, we have developed a course structure which is dedicated to helping you gain the skills needed to succeed not only in this course but in the rest of your degree.

Please note: The flexibility of the course design is designed with you in mind but has its limitations, inherent to a 9-week teaching period. Though you have multiple opportunities to attempt and pass the core assessments in this course it does not mean that you can put off the course work until last minute. You should always be aiming to sit the first assessment opportunity offered – this will afford you the maximum opportunity to pass.

The format and learning activities are different to many other courses and so we recommend you read all the following information carefully.

Threshold Knowledge and Core Skills

These are the fundamental skills you need to know and do to pass this course. They provide you with the minimum acceptable foundation to continue in your studies. Achieving these skills sets

you up to engage with the rest of the course. For this reason, we require you to complete assessment tasks throughout the term which demonstrate to us that you have obtained these skills in order to achieve the pass level marks for the course. We have built the course to give you MULTIPLE opportunities to achieve these tasks. **Once you have demonstrated that you have all these skills you will be awarded up to 50% of the course mark.**

Mastery Knowledge and Non-Core Skills

These are the important skills you need to complete the rest of the course. These concepts explore the applications and value of chemistry in our world and piece together the threshold knowledge to give meaning and context to your studies. Demonstrating your 'mastery' of this knowledge in your final exam and lab non-core skills will allow you to earn a merit grade (CR, DN, HD) in this course.

Lectures (lectures in timetable, face to face or online)

You may enrol in either the online stream or in person attendance. We recommend attending in person, as interaction in the online stream will be minimal. Lecture recordings will made available on Moodle for later revision.

Students are expected to engage with all lectures each week. You should take notes and participate in problem-solving during lectures. The questions asked in lectures are a valuable source of feedback – they will help you to target the areas that will require further clarification in your personal study time

Tutorials (face to face only)

Attendance at all tutorials is compulsory as no worked answers to tutorial problems are provided outside of these sessions. Tutorial classes are not graded directly but exam questions are linked to the tutorial material. Tutorials will be in person on campus (check your schedule for time and place).

The purpose of tutorials is to provide activities for students that consolidate the concepts covered in lectures. Students are expected to come prepared by having attempted the assigned pre work. They are expected to engage in tutorials by seeking help and completing work as directed.

Laboratory Classes (face to face only)

The laboratory classes provide an opportunity to learn the concepts and practice the calculations presented in lectures. Laboratory classes are also the place to learn practical skills and they are also the place where those skills are assessed.

You must **READ THE INTRODUCTION IN THE LABORATORY MANUAL** to be aware of all the requirements for passing the laboratory component of this course. Here are some of the main points regarding laboratory classes:

- **The following items of personal protective equipment (PPE) must be worn at all times in the laboratory:**
  - safety eyewear
  - a laboratory coat
  - fully enclosed footwear

You will not be permitted to work in thongs or open-top shoes or sandals or without a laboratory coat, facemask or safety eyewear.

- The schedule of experiments can be found on page 4 of the lab manual.
- All experiments require pre-lab work to be completed before your lab class.
- You must attend the laboratory class shown on your official timetable.
- You must arrive at the laboratory on time or you will be excluded from the class.
- Repeat students must apply to the First Year Laboratory Coordinator before the end of week 2 if they want exemption from laboratory classes. Exemption is not automatic and is decided on a case-by-case basis.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Weekly Quizzes Assessment Format: Individual	10%	Start Date: Weekly on Monday at 8 am Due Date: Weekly on Sunday at 11:59 pm (Quiz 1 and 2 due on same day, quiz 3 and 4 due on same day)
Threshold topic tests Assessment Format: Individual	30%	Due Date: First sittings in week 5 and 9
Laboratory work Assessment Format: Individual	20%	Due Date: Weekly in class
Final examination Assessment Format: Individual	40%	Start Date: Not Applicable Due Date: During the final exam period

Assessment Details

Weekly Quizzes

Assessment Overview

There are 10 weekly online quizzes (each worth 1%) for you to complete in weeks 1–5 and 7–10 inclusive. Most weeks require the submission of one quiz, with two quizzes submitted in week 3 only.

These quizzes cover the threshold content of the syllabus, which is covered by the online lessons that you are recommended to complete beforehand.

Each quiz consists of 10 questions, which are mostly multiple choice questions.

You must score 10/10 on at least one attempt before the due date, in order to successfully complete the quiz and be awarded a mark for that quiz. You have an unlimited number of attempts at each quiz, but you'll most likely get different versions of the questions on each attempt. After each attempt you will be given instant feedback based on your answers.

If you do not meet these criteria before the due date, you will get a mark of 0 for that quiz.

Course Learning Outcomes

- CLO1 : Describe the mechanisms of simple organic and inorganic reaction procedures and predict the products that are formed.
- CLO2 : Apply the language of chemistry to the naming and representation of the stereochemistry of chemical substances and describe methods that can be used to confirm these chemical structures. (e.g. mass spectrometry, infrared spectroscopy, UV-visible spectroscopy, nuclear magnetic resonance spectroscopy).
- CLO3 : Describe the kinetics of chemical processes, contrast the outcomes predicted by thermodynamics and kinetics, and analyse reactions in kinetic terms.
- CLO4 : Analyse problems and prepare calculations to give estimates of chemical and physical quantities (such as mass balance and energy balance), for chemical engineering processes.

Assessment Length

10 questions

Assignment submission Turnitin type

Not Applicable

Threshold topic tests

Assessment Overview

There are two in-term tests each worth up to 15% of the course marks. In-term test 1 is in week 5 and assesses threshold topics 1-4 (kinetics to chemical structure). In-term test 2 is in week 9 and assesses threshold topics 5-8 (structure determination to nucleophilic addition).

The in-term tests are designed as a summative validation of your learning of the fundamental skills you need to know and do to pass this course. Each test is typically a 45 minute test with 20 multiple choice questions, and these are drawn from the same question bank as the weekly threshold quizzes.

The threshold mark for each in-session test is 15/20. You must achieve the threshold mark or higher to be awarded course marks for this assessment. You will receive feedback within a few days of the test, and this will outline the questions answered incorrectly and link these to the threshold learning outcome they were assessing.

There will be multiple opportunities to re-sit the test in subsequent weeks if you do not achieve the threshold mark in earlier sittings, however the result will be capped at the pass mark of 15/20. The deadline for achieving the threshold mark for test one is the end of week 7 and for test two it is the end of week 10.

Course Learning Outcomes

- CLO1 : Describe the mechanisms of simple organic and inorganic reaction procedures and predict the products that are formed.
- CLO2 : Apply the language of chemistry to the naming and representation of the stereochemistry of chemical substances and describe methods that can be used to confirm these chemical structures. (e.g. mass spectrometry, infrared spectroscopy, UV-visible spectroscopy, nuclear magnetic resonance spectroscopy).
- CLO3 : Describe the kinetics of chemical processes, contrast the outcomes predicted by thermodynamics and kinetics, and analyse reactions in kinetic terms.
- CLO4 : Analyse problems and prepare calculations to give estimates of chemical and physical quantities (such as mass balance and energy balance), for chemical engineering processes.

Assessment Length

20 questions, 45 minutes

Assignment submission Turnitin type

Not Applicable

Laboratory work

Assessment Overview

The laboratory classes are designed to provide you with practical experience in the lab as well as developing your observational and data analysis skills. You will be provided with feedback on your progress from your demonstrator during lab classes as well as through a personalized feedback web page that allows you to track and visualize your skill development.

You are required to attend a minimum of 6/8 laboratory classes to meet the hurdle pass requirement for this course.

Laboratory work is assessed in two parts:

Core skills: You are required to achieve all core skills as a hurdle requirement to pass this course. You will be given multiple opportunities across several lab classes to demonstrate each core skill. Your demonstrator will communicate with you when you have been marked as competent for a given skill. Once you have achieved all the core skills required in the lab you will be awarded 10% of the course marks.

Non-core skills : Each of the 8 laboratory exercises will require you to complete questions relating to the non-core skills listed for that lab. Work is either marked in lab, or a report is submitted for marking (according to the schedule in the laboratory manual). The grades for these are tracked on your personalized feedback page and will total 10% of the available course marks across the 8 laboratory classes.

Course Learning Outcomes

- CLO5 : Work safely in a laboratory to manipulate apparatus, perform quantitative and qualitative chemical analysis, synthesize compounds, separate mixtures of compounds, evaluate the accuracy and precision of measurements, and to interpret results and observations.

Assignment submission Turnitin type

Not Applicable

Hurdle rules

- You must attend at least 6 laboratory classes
- You must be awarded all core laboratory skills

Final examination

Assessment Overview

The final exam is designed to summarize your learning and problem-solving skills on all topics covered in the course, including material from lectures, tutorials and labs. The final exam will focus on the “mastery” content of the entire syllabus, but it will also require you to remember the “threshold” concepts as a foundation for answering the mastery questions.

The exam is typically 2hrs 10 minutes and consists of MCQ, short numerical and short answer responses - details will be confirmed during the course. The examination will occur during the

official university examination period. Feedback is available through inquiry with the course convenor.

Course Learning Outcomes

- CLO1 : Describe the mechanisms of simple organic and inorganic reaction procedures and predict the products that are formed.
- CLO2 : Apply the language of chemistry to the naming and representation of the stereochemistry of chemical substances and describe methods that can be used to confirm these chemical structures. (e.g. mass spectrometry, infrared spectroscopy, UV-visible spectroscopy, nuclear magnetic resonance spectroscopy).
- CLO3 : Describe the kinetics of chemical processes, contrast the outcomes predicted by thermodynamics and kinetics, and analyse reactions in kinetic terms.
- CLO4 : Analyse problems and prepare calculations to give estimates of chemical and physical quantities (such as mass balance and energy balance), for chemical engineering processes.

Assessment Length

2 hours 10 minutes

Assignment submission Turnitin type

Not Applicable

General Assessment Information

Grading Basis

Standard

Requirements to pass course

- You must attend a minimum of 6 laboratory classes
- You must be awarded all core laboratory skills (see laboratory manual for more details).
- You must achieve a course mark of at least 50

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Lecture	Per Zetterlund
	Laboratory	Rates of Chemical Reactions
	Tutorial	Chemical Kinetics
	Assessment	Kinetics
Week 2 : 3 June - 9 June	Lecture	Per Zetterlund
	Laboratory	Energy Balances and Energy Flows/ Research interviews
	Tutorial	Heat Transfer and Mass Balance
	Assessment	Material Balance
Week 3 : 10 June - 16 June	Lecture	Per Zetterlund / Jeffrey Black
	Laboratory	Partition Coefficients and Separation of Materials
	Tutorial	Chemical Structure and Stereochemistry
	Assessment	Energy Balance
	Assessment	Chemical Structure
	Other	Confirm you have set up a time for research interview by posting in Moodle Forum.
Week 4 : 17 June - 23 June	Lecture	Jeffrey Black
	Laboratory	Stereochemistry and Isomerism
	Tutorial	Structure Determination
	Assessment	Structure Determination
Week 5 : 24 June - 30 June	Lecture	Jeffrey Black
	Laboratory	Synthesis and Purification – Aspirin
	Tutorial	Electrophiles, Nucleophiles and Alkene Chemistry
	Assessment	Alkene Chemistry
	Assessment	First sitting on In Term Test 1
Week 6 : 1 July - 7 July	Laboratory	Make up lab classes (if required)
Week 7 : 8 July - 14 July	Lecture	Jeffrey Black
	Laboratory	Reactions and Identification of Organic Compounds
	Tutorial	Curly Arrows and Aromatic Chemistry
	Assessment	Electrophilic Aromatic Substitution
	Assessment	Submit your research interview report by 5 pm Friday.
Week 8 : 15 July - 21 July	Lecture	DJ Kim
	Laboratory	Determination of Copper
	Tutorial	Alcohols, Alkyl Halides and Carbonyl Chemistry
	Assessment	SN1, SN2 and Nucleophilic Addition
Week 9 : 22 July - 28 July	Lecture	DJ Kim
	Laboratory	Synthesis and Analysis – Iron oxalate complex
	Tutorial	Main Group Chemistry
	Assessment	Main Group Chemistry
	Assessment	First sitting on In Term Test 2
Week 10 : 29 July - 4 August	Lecture	DJ Kim
	Laboratory	Make up lab classes (if required)
	Tutorial	Transition Metal Chemistry
	Assessment	Transition Metals

Attendance Requirements

Laboratory class attendance is compulsory.

Students are strongly encouraged to attend all tutorial classes and recordings are not available.

General Schedule Information

Each week students are expected to attend lectures, a tutorial class and a lab class. In addition to this they are expected to complete a weekly quiz on each topic.

Course Resources

Prescribed Resources

Laboratory Manual and Tutorial Notes

- A printed course pack is available to purchase in book shop, or digital files can be downloaded from Moodle
- Note you must bring a blank printed copy of the relevant lab report to your weekly lab classes.

Recommended Resources

Brown, Lemay, Bursten, Murphy, Woodward, Langford, Sagatys, George, "Chemistry: The Central Science," 3rd Ed, Pearson

- This book is available in print through the UNSW Bookshop: https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9781442554603&11443986 or in print or as a digital copy from Pearson: https://www.pearson.com/store/p/chemistry-the-central-science/P200000007905/9781442559462

Aylward and Findlay, "SI Chemical Data," 6th Ed. or later

- Available from the UNSW Bookshop: https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9780730302469

Additional Costs

The following PPE must be supplied by students:

- Cotton button up lab coat
- Safety glasses

These can be purchased in the bookshop or grad store on campus or at outside retailers (e.g. hardware stores)

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Lecturer	Jeffrey Black (Course Coordinator)				Please send course enquiries to firstyearchem@unsw.edu.au unless the enquiry is highly personal.	Yes	Yes
	Per Zetterlund					No	No
	DJ Kim					No	No
Administrator	First Year Support					No	No
	Ron Haines (1st Year Lab Coordinator)					No	No

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the UNSW Student Code of Conduct Website.

Academic Honesty and Plagarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.
Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as

a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.
Further information about academic integrity, plagiarism and the use of AI in assessments can be located at:

- The Current Students site,
- The ELISE training site, and
- The Use of AI for assessments site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a "fit to sit/submit" rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- The Current Students Gateway
- Student Support
- Academic Skills and Support
- Student Wellbeing, Health and Safety
- Equitable Learning Services
- UNSW IT Service Centre
- Science EDI Student Initiatives, Offerings and Guidelines

School-specific Information

UNSW Changes to Special Consideration: Short Extension

The School of Chemistry has carefully reviewed all of its assessments to determine whether they are suitable for automatic short extensions as set out by the UNSW Short Extension Policy. The current deadline structures for all assessment tasks in the School of Chemistry already accommodate the possibility of unexpected circumstances that may lead students to require additional time for submission. **The School of Chemistry has opted out of the UNSW Short Extension provision for all its courses,** and we have already integrated flexibility into our assessment deadlines. This decision is subject to revision in response to the introduction of new course offerings. All students may still apply for Special Consideration for any assessment via the usual procedures.

School Contact Information

Level 1, Dalton Building (F12)

W: www.chemistry.unsw.edu.au

Also see: ***Contacts and Support*** section of the course Moodle page (where applicable)