



# CHEM3601

## Advanced Synthesis

Session 2, In person-scheduled-weekday, North Ryde 2024

*School of Natural Sciences*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

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Credit points

10

Prerequisites

20cp in CBMS or BMOL or CHEM units at 2000 level or above including (CHEM2601 or CBMS203 or CBMS204)

Corequisites

Co-badged status

### Unit description

This unit examines advanced topics in modern synthetic organic and inorganic chemistry. Specific topics may include: synthesis with selectivity, coordination chemistry, heterocyclic chemistry, rearrangement reactions, pericyclic reactions and advanced spectroscopic methods. These topics build upon the foundation of "CHEM2601 Synthesis", using the same text books supplemented with inexpensive Oxford Chemistry Primers on the specified topics. This unit requires strong skills in organic and inorganic chemistry, while a background in other aspects of chemistry will be advantageous. The laboratory sessions are aimed at developing skills in organic and inorganic synthesis and in the spectroscopic identification of organic and inorganic compounds.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

- ULO1:** Apply knowledge of the fundamental molecular properties affecting chemical reactivity and selectivity to predict the products and propose the mechanisms of a range of organic and inorganic reactions.
- ULO2:** Use the primary scientific literature to plan efficient synthetic routes to complex organic and inorganic molecules starting from simple building blocks.
- ULO3:** Assess the risks and hazards associated with working in a synthetic laboratory environment and apply appropriate processes and controls to minimise these risks.
- ULO4:** Employ a set of advanced laboratory techniques to synthesise and purify selected organic and inorganic compounds safely and efficiently.
- ULO5:** Use modern spectroscopic techniques to elucidate the structures of organic and inorganic compounds.
- ULO6:** Communicate experimental observations clearly, concisely and accurately in the form of written scientific reports.

## General Assessment Information

### Requirements to Pass this Unit

To pass this unit you must:

- Achieve a total mark equal to or greater than 50%, and...
- Achieve a mid-semester test mark equal to or greater than 40%.

### Hurdle Assessments

- **Mid-Semester Test (15%).** To pass this unit, you will need to demonstrate ongoing development of skills and application of knowledge. This progress will be assessed in the form of a 50-minute on-campus closed-book written test covering unit content up to and including Week 6. To pass this test, you must achieve a mark equal to or greater than 40%. This is a hurdle assessment, meaning that failure to meet this requirement may result in a fail grade for the unit. Students who make a serious attempt at the test (defined as achieving a mark between 30% and 39%) but fail to clear the hurdle will be offered a second attempt in the form of a supplementary mid-semester test, to be administered within 1 week of the marks being returned for the original test.

### Late Assessment Submission Penalty

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark) will be applied each day a written assessment is not submitted, up until the 7<sup>th</sup> day (including weekends). After the 7<sup>th</sup> day, a grade of '0' will be awarded even if the assessment is submitted. Submission time for all written assessments is set at **11:55 pm**. A 1-hour grace period is provided to students who experience a technical concern. For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, students need to submit an application for [Special Consideration](#).

### Assessments where Late Submissions will be accepted

In this unit, late submissions will accepted as follows:

- Laboratory Reports – YES, Standard Late Penalty applies
- Workshop Preparation – NO, unless Special Consideration is granted

### Special Consideration

The [Special Consideration Policy](#) aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable and significantly disruptive, and which may affect their performance in assessment. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the convenor and submit a Special Consideration request through [ask.mq.edu.au](http://ask.mq.edu.au).

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Mid-Semester Test</a>	15%	Yes	Week 8
<a href="#">Workshop Performance</a>	10%	No	Weeks 2,3,8,13
<a href="#">Practical Classes</a>	35%	No	Weeks 6,8,9,10,12,13
<a href="#">Final Examination</a>	40%	No	Exam Period

### Mid-Semester Test

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 9 hours

Due: **Week 8**

Weighting: **15%**

**This is a hurdle assessment task (see [assessment policy](#) for more information on hurdle assessment tasks)**

A one-hour test covering all material presented in the first half of the unit. The test will consist of a combination of short-answer and mechanism-based questions.

On successful completion you will be able to:

- Apply knowledge of the fundamental molecular properties affecting chemical reactivity and selectivity to predict the products and propose the mechanisms of a range of organic and inorganic reactions.
- Use modern spectroscopic techniques to elucidate the structures of organic and inorganic compounds.

## Workshop Performance

Assessment Type <sup>1</sup>: Problem set

Indicative Time on Task <sup>2</sup>: 5 hours

Due: **Weeks 2,3,8,13**

Weighting: **10%**

Workshops consist of interactive problem solving sessions focused on exam-style questions. The workshops are designed to develop independence in problem solving and provide students with an opportunity to ask questions and receive immediate feedback on their work. Students are graded based on their level of preparedness and participation in each workshop.

On successful completion you will be able to:

- Apply knowledge of the fundamental molecular properties affecting chemical reactivity and selectivity to predict the products and propose the mechanisms of a range of organic and inorganic reactions.
- Use the primary scientific literature to plan efficient synthetic routes to complex organic and inorganic molecules starting from simple building blocks.
- Use modern spectroscopic techniques to elucidate the structures of organic and inorganic compounds.

## Practical Classes

Assessment Type <sup>1</sup>: Lab report

Indicative Time on Task <sup>2</sup>: 25 hours

Due: **Weeks 6,8,9,10,12,13**

Weighting: **35%**

Practical classes with discrete laboratory-based experiments spanning the whole semester. The lab sessions provide advanced practical training in a range of modern synthetic chemistry techniques and allow students to apply the knowledge gained in lectures to solve synthetic challenges safely and efficiently. Students must maintain a laboratory notebook for the duration of the unit, conduct comprehensive risk assessments and produce concise lab reports for the experiments performed.

On successful completion you will be able to:

- Apply knowledge of the fundamental molecular properties affecting chemical reactivity and selectivity to predict the products and propose the mechanisms of a range of organic and inorganic reactions.
- Use the primary scientific literature to plan efficient synthetic routes to complex organic and inorganic molecules starting from simple building blocks.
- Assess the risks and hazards associated with working in a synthetic laboratory environment and apply appropriate processes and controls to minimise these risks.
- Employ a set of advanced laboratory techniques to synthesise and purify selected organic and inorganic compounds safely and efficiently.
- Use modern spectroscopic techniques to elucidate the structures of organic and inorganic compounds.
- Communicate experimental observations clearly, concisely and accurately in the form of written scientific reports.

## Final Examination

Assessment Type <sup>1</sup>: Examination

Indicative Time on Task <sup>2</sup>: 15 hours

Due: **Exam Period**

Weighting: **40%**

A three-hour examination covering course material from Weeks 1-13. The examination will assess understanding of all the topics presented within the course and the ability to apply the

knowledge gained to solve new problems. The examination will consist of a combination of short-answer and mechanism-based questions.

On successful completion you will be able to:

- Apply knowledge of the fundamental molecular properties affecting chemical reactivity and selectivity to predict the products and propose the mechanisms of a range of organic and inorganic reactions.
- Use modern spectroscopic techniques to elucidate the structures of organic and inorganic compounds.

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<sup>1</sup> If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Writing Centre](#) for academic skills support.

<sup>2</sup> Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

## Delivery and Resources

### Overview

CHEM3601 Advanced Synthesis is a 10 credit point unit requiring 150 hours of work over the semester (formal contact hours and self study time). This is an average of 10 hours of work per week over each of the 15 weeks of semester. Formal contact hours for CHEM3601 consist of 2 hours of lectures per week, along with 4 x 3-hour interactive workshops and 7 x 4-hour laboratory classes throughout semester. Students are strongly encouraged to participate in all lectures, workshops and laboratory classes. Active participation by students in all of these activities will be essential for success in the unit.

### Lectures

NOTE: Lectures begin in Week 1

The unit will cover 2 hours of lecture material each week. You should use these lectures as a starting point and supplement their content with material from the text books, the scientific literature and from other reputable online sources. The unit content builds on material covered in previous weeks, so it will be essential to keep up to date with the lecture material throughout the semester.

### Workshops

Note: Workshops begin in Week 2, but pre-workshop preparation is due in Week 1

Workshops consist of interactive problem solving sessions focused on exam-style questions. The workshops are designed to develop independence in problem solving and provide students with an opportunity to ask questions and receive immediate feedback on their work. Students are graded based on their level of preparedness and participation in each workshop.

### Laboratory Classes

Note: Laboratory classes begin in Week 4, but risk assessments and pre-laboratory preparation is due in Week 3

You should use the allocated session in Week 1 to familiarise yourselves with the requirements of the practical component of the unit, to watch the essential lab technique videos provided on Echo360 and to complete all relevant prelab exercises, hazard identification and risk assessments for the first experiment. Before commencing each new experiment, you are required to complete the prelab component in your laboratory notebook. This includes completing all risk assessments, flowcharts and answering any associated prelab questions. Failure to do so will result in your exclusion from the practical, with consequences for the successful completion of the course. You must read each experiment carefully before attending the lab. Laboratory reports must be submitted through iLearn by the posted due dates. Please refer to the Laboratory Manual provided on iLearn for full details of specific requirements for each laboratory class.

### Communication

The web page for this unit can be found at [ilearn.mq.edu.au](https://ilearn.mq.edu.au).

Login with your MQ student ID number and password, then follow the prompts to "CHEM3601 Advanced Synthesis."

During semester, the CHEM3601 iLearn site will be used to communicate important information to you. It is your responsibility to regularly check the iLearn site for important announcements and updates.

We will communicate with you via your **university email address** or through the Announcements discussion board on iLearn. Queries to convenors can either be placed on the iLearn discussion board or emailed directly to the Unit Convenor from your **university email address**.

### Office Hours

There are no formal office hours for this unit. The teaching staff are happy to receive students outside of the formal lecture, workshop and practical times, but please be aware that we are not always to be found in our offices. It is generally wise to organise an appointment in advance via email (using your university email address).

### Recommended Text Books

- "Organic Chemistry", 10th Edition (2023) by John McMurry; Free from [OpenStax](https://openstax.org).
- "Organic Chemistry", 2nd Edition (2012) by Jonathan Clayden; Oxford University Press. Online copies may be available.



- "The Organometallic Chemistry of the Transition Metals", 6th Edition (2014) by Robert H. Crabtree. QD411.8.T73 C73
- "Aromatic Heterocyclic Chemistry", (1992) by David T. Davies; Oxford Chemistry Primer QD411.8.T73 C73
- "Pericyclic Reactions", (1999) by Ian Fleming; Oxford Chemistry Primer QD281.R5 F58
- "Polar Rearrangements", (1992) by Laurence M. Harwood; Oxford Chemistry Primer QD281.R35.H37/1992
- "Introduction to Organic Spectroscopy", (1996) by Laurence M. Harwood and Timothy D. W. Claridge; Oxford Chemistry Primer QD272.S6.H37
- "Organometallics 2: Complexes with Transition Metal-Carbon  $\pi$  bonds: (1994) by Manfred Bochmann; Oxford Chemistry Primer. QD411.8.T73 B63 1994 V.2

### Suggested Reading for Organometallic Chemistry

- "Applied Organometallic Chemistry and Catalysis" (2001) by Robin Whyman; Oxford Chemistry Primer. QD411.W48 2001
- "Organometallics 1: Complexes with Transition Metal-Carbon  $\alpha$ -bonds" (1994) by Manfred Bochmann; Oxford Chemistry Primer. QD411.8.T73 B63 1994 V.1

### Suggested Reading for Spectroscopic Identification of Organic Compounds

- "Structural identification of organic compounds with spectroscopic techniques" (2005) Yong-Cheng Ning QD272.S6 N56
- "Introduction to spectroscopy: A guide for students of organic chemistry" 2001 Donald L. Pavia, Gary M. Lampman, George S. Kriz QD272.S6.P38 2001
- "Practical spectroscopy: The rapid interpretation of spectral data: For McMurry's Organic Chemistry, fifth edition" 2000 Paul R. Young QD95.Y68

Textbooks can be purchased from Booktopia (<https://www.booktopia.com.au/>). You can also find a number of textbooks with "Organic Chemistry" and "Inorganic Chemistry" in the title in the University library. All cover similar material, but often use different notation. You may find that some of these other books explain certain topics more clearly. There are also many web resources, but material placed on the web is not necessarily checked for accuracy, so use with caution.

### COVID Information

For the latest information on the University's response to COVID-19, please refer to the Coronavirus infection page on the Macquarie website: <https://www.mq.edu.au/about/coronavirus-faqs>. Remember to check this page regularly in case the information and requirements change during semester. If there are any changes to this unit in relation to COVID, these will be communicated via iLearn.

## Unit Schedule

Please check the iLearn site for this unit for the most up-to-date Unit Schedule

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Assessment Procedure](#)
- [Complaints Resolution Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

Students seeking more policy resources can visit [Student Policies \(https://students.mq.edu.au/support/study/policies\)](https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au) and use the [search tool](#).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/admin/other-resources/student-conduct>

## Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [connect.mq.edu.au](https://connect.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## Academic Integrity

At Macquarie, we believe [academic integrity](#) – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free [online writing and maths support](#), [academic skills development](#) and [wellbeing consultations](#).

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

### The Writing Centre

[The Writing Centre](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Workshops](#)
- [Chat with a WriteWISE peer writing leader](#)
- [Access StudyWISE](#)
- [Upload an assignment to Studiosity](#)
- [Complete the Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

## Student Services and Support

Macquarie University offers a range of [Student Support Services](#) including:

- [IT Support](#)
- [Accessibility and disability support](#) with study
- Mental health [support](#)
- [Safety support](#) to respond to bullying, harassment, sexual harassment and sexual assault
- [Social support including information about finances, tenancy and legal issues](#)
- [Student Advocacy](#) provides independent advice on MQ policies, procedures, and processes

## Student Enquiries

Got a question? Ask us via the [Service Connect Portal](#), or contact [Service Connect](#).

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.

## Changes from Previous Offering

No significant changes have been made since the previous offering.

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Unit information based on version 2024.01R of the [Handbook](#)