



# CHEM3601

## Advanced Synthesis

Session 2, Special circumstances, North Ryde 2021

*Archive (Pre-2022) - Department of Molecular Sciences*

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### Disclaimer

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### Session 2 Learning and Teaching Update

The decision has been made to conduct study online for the remainder of Session 2 for all units WITHOUT mandatory on-campus learning activities. Exams for Session 2 will also be online where possible to do so.

This is due to the extension of the lockdown orders and to provide certainty around arrangements for the remainder of Session 2. We hope to return to campus beyond Session 2 as soon as it is safe and appropriate to do so.

Some classes/teaching activities cannot be moved online and must be taught on campus. You should already know if you are in one of these classes/teaching activities and your unit convenor will provide you with more information via iLearn. If you want to confirm, see the list of [units with mandatory on-campus classes/teaching activities](#).

Visit the [MQ COVID-19 information page](#) for more detail.

## General Information

Unit convenor and teaching staff

Unit Convenor, Lecturer

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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

CHEM6631

**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.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#"><u>Practical Classes</u></a>	25%	No	Reports due Weeks 6, 7, 8, 9, 12, 13
<a href="#"><u>Workshop Performance</u></a>	15%	No	Weeks 2, 3, 7, 10/11, 13

Name	Weighting	Hurdle	Due
<u>Mid-Semester Test</u>	10%	No	Week 7
<u>Final Examination</u>	50%	No	Formal exam period

## Practical Classes

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

Indicative Time on Task <sup>2</sup>: 20 hours

Due: **Reports due Weeks 6, 7, 8, 9, 12, 13**

Weighting: **25%**

Six 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.

## Workshop Performance

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

Indicative Time on Task <sup>2</sup>: 10 hours

Due: **Weeks 2, 3, 7, 10/11, 13**

Weighting: **15%**

Five workshops consisting 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.

## Mid-Semester Test

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

Indicative Time on Task <sup>2</sup>: 6 hours

Due: **Week 7**

Weighting: **10%**

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.

## Final Examination

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

Indicative Time on Task <sup>2</sup>: 18 hours

Due: **Formal exam period**

Weighting: **50%**

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

### Communication

During the 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

### Office Hours

There are no formal office hours for this unit. The teaching staff are happy to receive students outside of the formal lecture 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, generally via email (using your university email address).

### Recommended Text Books

"Organic Chemistry", 9th Edition (2016) by John McMurry; Cengage Learning (this is the same

book as for CHEM2601). 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  $\sigma$ -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 also many web resources, but material placed on the web is not necessarily checked for accuracy, so be careful when using it.

### **Technology Used and Required**

You must regularly check the unit web page for course related information. The web page for this unit can be found at: <http://ilearn.mq.edu.au>

### **Teaching and Learning Strategy**

Lectures will be presented as a combination of formal lectures (or recordings of lectures) and interactive Q&A sessions. Historically, non-attendance at lectures has had a significant

deleterious effect that is ultimately reflected in poor final exam performance. It is your responsibility to manage your own study/work/life balance.

**Class Timetable:** Please check <http://www.timetables.mq.edu.au> for the official timetable of the unit.

**Laboratory sessions:** 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.

**Postlab questions and Practical Reports:** Postlab questions and practical reports must be submitted through iLearn by the posted due dates. Penalties for late submissions will accumulate at the rate of 10% per day overdue unless special consideration has been approved through AskMQ.

## Unit Schedule

Topics covered will be selected from:

- Advanced Organic Spectroscopy
- Aromaticity and Heterocycles
- Pericyclic Reactions
- Polar Rearrangements
- Metal-oriented Reactions
- Pi-Ligands
- Principles of Catalysis
- Metal Carbene Complexes

Please refer to the unit iLearn page 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](#)
- [Grade Appeal Policy](#)
- [Complaint Management 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 [ask.mq.edu.au](http://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## Student Support

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

## Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to help you improve your marks and take control of your study.

- [Getting help with your assignment](#)
- [Workshops](#)
- [StudyWise](#)
- [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

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## 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

In 2021, the organic chemistry section has additional material on aromaticity/heterocycles and pericyclic reactions, with the removal of some material associated with polar rearrangements and organic spectroscopy. The inorganic section remains unchanged.