CBMS303

Advanced Synthesis

S2 Day 2019

Dept of Molecular Sciences

Contents

General Information

Unit convenor and teaching staff
Unit Convenor and Lecturer
Andrew Piggott
andrew.piggott@mq.edu.au
Contact via 9850 8251
4WW 334
Arrange appointment via email

Lecturer
Peter Karuso
peter.karuso@mq.edu.au
Contact via 9850 8290
4WW 232
Arrange appointment via email

Lecturer
Koushik Venkatesan
koushik.venkatesan@mq.edu.au
Contact via 9850 8296
4WW 123
Arrange appointment via email

Credit points
3

Prerequisites
6cp in CBMS units at 200 level or above including (CBMS203 or CBMS204)

Corequisites

Co-badged status

Unit description
This unit examines advanced topics in organic chemistry and inorganic chemistry. Specific topics may include: synthesis with selectivity, coordination chemistry, rearrangement reactions and advanced spectroscopic methods. These topics build upon the foundation of CBMS203, using the same text books supplemented with inexpensive Oxford Chemistry Primers on the specified topics. This unit requires good skills in organic and inorganic chemistry; a background in other aspects of chemistry will be advantageous. The laboratory sessions are aimed at developing skills in organic and inorganic synthesis, using reactions studied in lectures and in the spectroscopic identification of organic 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:

Apply, both at theoretical and practical level, a set of advanced synthetic techniques

Communicate chemical knowledge by appropriately documenting the essential details of procedures undertaken, key observations, results and conclusions, and present information with articulate arguments and conclusions, in a variety of modes, to diverse audiences, and for a range of purposes

Use modern spectroscopic techniques in the structure elucidation of organic and inorganic compounds from synthesis and nature

Have a chemical understanding of carbocation/carbanion stability and reactivity

Predict the products and deduce the mechanisms of organic and inorganic reactions given the starting material and reagents

Plan and carry out a syntheses of organic and inorganic compounds using literature methods

Assessment Tasks

Name	Weighting	Hurdle	Due
Practical Classes	25%	No	1 week after the lab
Workshop Performance	15%	No	Weeks 5, 6, 7, 8, 13
Mid-semster Test	10%	No	Week 8 in the Lecture
Final Examination	50%	No	University Examination Period

Practical Classes

Due: **1 week after the lab**
Weighting: **25%**

The practical component of the unit consists of FIVE practical experiments worth 5% each. You will be expected to maintain a laboratory notebook for the duration of the unit. Before each practical class, you must complete the corresponding pre-lab exercises, flow diagram, hazard identification and risk assessments in your laboratory notebook. These must be signed off BEFORE you can commence lab work. No later than one week after each experiment, you must

submit a concise report consisting of an introduction summarising the aims of the experiment, a summary of the experimental work performed in a style consistent with organic chemistry journals, calculations of yields, a discussion (including relevant spectra), a comparison with literature related to the work (including appropriate references), and answers to all post-lab questions. A marking rubric will be provided.

On successful completion you will be able to:

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- Use modern spectroscopic techniques in the structure elucidation of organic and inorganic compounds from synthesis and nature
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- Predict the products and deduce the mechanisms of organic and inorganic reactions given the starting material and reagents
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Workshop Performance

Due: **Weeks 5, 6, 7, 8, 13**
Weighting: **15%**

You will be graded on your level of preparedness and participation. These workshops involve interactive problem solving sessions. Exam-style questions will also be completed.

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- Predict the products and deduce the mechanisms of organic and inorganic reactions given the starting material and reagents

- Plan and carry out a syntheses of organic and inorganic compounds using literature methods

Mid-semster Test

Due: **Week 8 in the Lecture**
Weighting: **10%**

A one-hour examination covering the first 7 weeks of course material.

On successful completion you will be able to:

- Apply, both at theoretical and practical level, a set of advanced synthetic techniques
- Use modern spectroscopic techniques in the structure elucidation of organic and inorganic compounds from synthesis and nature
- Have a chemical understanding of carbocation/carbanion stability and reactivity
- Predict the products and deduce the mechanisms of organic and inorganic reactions given the starting material and reagents
- Plan and carry out a syntheses of organic and inorganic compounds using literature methods

Final Examination

Due: **University Examination Period**
Weighting: **50%**

A three-hour final examination covering all 13 weeks of course material

On successful completion you will be able to:

- Apply, both at theoretical and practical level, a set of advanced synthetic techniques
- Use modern spectroscopic techniques in the structure elucidation of organic and inorganic compounds from synthesis and nature
- Have a chemical understanding of carbocation/carbanion stability and reactivity
- Predict the products and deduce the mechanisms of organic and inorganic reactions given the starting material and reagents
- Plan and carry out a syntheses of organic and inorganic compounds using literature methods

Delivery and Resources

Communication

During the semester, the CBMS303 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).

Required Text Books

"Organic Chemistry", 9th Edition (2016) by John McMurry; Cengage Learning (this is the same book as for CBMS203).

"The Organometallic Chemistry of the Transition Metals", 6th Edition (2014) by Robert H. Crabtree. QD411.8.T73 C73

"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 π 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 α-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

Summaries of lecture material, lecture guides or directions to web-based material may also be provided.

You can 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 and interactive tutorial sessions. Most of the lecture material will be available on the unit website, while there will be some provided in the lecture class. Historically, non-attendance at lectures has a much more deleterious effect that is ultimately reflected in exam performance. It is your responsibility to manage your own study/work/life balance. Circumstances such as routine demands of employment/financial need or extra-curricular activities, routine family problems, and difficulties adjusting to university life and stress associated with the demands of academic work, are not unforeseeable circumstances beyond your control and should not be used as an excuse to miss a lecture.

Classes Timetable: Please check http://www.timetables.mq.edu.au for the official timetable of the unit.

Laboratory sessions commence in Week 2. You should use the allocated session in Week 1 to familiarise yourselves with the requirements of the practical component of the unit 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.

Due Date for Practical Reports: Electronic (typed) practical reports must be submitted through iLearn no later than 7 days after completion of the lab. This generally means that each report will be submitted before the next lab session. Penalties for late submission will accumulate at the rate of 10% per day overdue.

Unit Schedule

Weeks 1-4: Polar Rearrangements (Prof. Peter Karuso)

Weeks 5-8: Advanced Spectroscopic Identification of Organic Compounds (Dr. Andrew Piggott)

Weeks 9-12: Inorganic Chemistry (A/Prof. Koushik Venkatesan)

Week 13: Revision

Learning and Teaching Activities

Lectures

The theory associated with the unit content is presented, including examples of how to approach problems encountered in the relevant areas

Workshops

Students work through problems (that are simliar to those encountered in the mid-session and final examinations) associated with the content of the relevant module

Laboratory Classes

The practical and report writing skills (including how to plan a synthetic scheme and interpret the results) required for a practising chemist are taught

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). 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 *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

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

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/study/getting-started/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 or if you are a Global MBA student contact 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) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

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

If you are a Global MBA student contact 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/.

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.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Apply, both at theoretical and practical level, a set of advanced synthetic techniques
- Plan and carry out a syntheses of organic and inorganic compounds using literature methods

Assessment tasks

- Practical Classes
- Workshop Performance
- Mid-semster Test
- Final Examination

Learning and teaching activities

- The theory associated with the unit content is presented, including examples of how to approach problems encountered in the relevant areas
- Students work through problems (that are simliar to those encountered in the mid-session and final examinations) associated with the content of the relevant module
- The practical and report writing skills (including how to plan a synthetic scheme and interpret the results) required for a practising chemist are taught

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

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Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcomes

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Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

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Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Apply, both at theoretical and practical level, a set of advanced synthetic techniques
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interpret the results) required for a practising chemist are taught

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

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Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication

technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

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Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning and teaching activities

- The theory associated with the unit content is presented, including examples of how to approach problems encountered in the relevant areas
- The practical and report writing skills (including how to plan a synthetic scheme and interpret the results) required for a practising chemist are taught

Changes from Previous Offering

The last offering of CBMS303 was in 2017, when the unit was named "Organic and Biological Chemistry A". The unit name has since changed to "Advanced Synthesis". The section on peptide chemistry has been replaced by the section on inorganic chemistry. There has also been a change of staff with Dr Fei Liu being replaced by A/Prof. Koushik Venkatesan and Dr Andrew Piggott replacing Prof. Peter Karuso as Unit Convenor.

Changes since First Published

Date	Description
10/07/2019	Updated due dates for Workshop assessments