



CBMS308

Chemical Analysis II

S1 Day 2014

Chemistry and Biomolecular Sciences

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Disclaimer

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General Information

Unit convenor and teaching staff

Lecturer

Christopher McRae

christopher.mcrae@mq.edu.au

Contact via christopher.mcrae@mq.edu.au

F7B 328

Students are encouraged to arrange a meeting via email.

Unit Convenor

Danny Wong

danny.wong@mq.edu.au

Contact via danny.wong@mq.edu.au

F7B 235

Credit points

3

Prerequisites

CBMS208 and (CBMS204 or CBMS207)

Corequisites

Co-badged status

CBMS308 is co-badged with CBMS708 and CBMS825.

Unit description

This unit covers advanced aspects of chemical analysis, building on the foundations laid in CBMS208. Modern chemical principles and practice of identifying substances and of determining their composition are discussed. Topics include many analytical techniques commonly employed in both industrial and academic research laboratories. Examples of applications to environmental and biological samples include: analysis of heavy metals by atomic absorption spectroscopy; inductively coupled plasma atomic emission spectroscopy; advanced chromatographic separation and detection; electrochemical detection of biochemicals and environmental pollutants; analysis by mass spectrometry. The unit emphasises hands-on experience in analysing real life samples, using many of these techniques. Each student also devotes a proportion of the semester to gain relevant work experience in off-campus laboratories in chemical industry and research organisations, such as CSIRO.

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:

Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.

To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.

Interpret and draw sound conclusions from analytical chemical data obtained.

Prepare written scientific documents at a satisfactory level.

Deliver with confidence an oral presentation on a selected topic in analytical chemistry.

Assessment Tasks

Name	Weighting	Due
<u>Assignments</u>	10%	March 25; April 14; May 12
<u>Laboratory Work</u>	40%	Week4,5,6,7,8,9,10,11,12,13
<u>Mid-Year 3-hour Examination</u>	50%	June 2014

Assignments

Due: **March 25; April 14; May 12**

Weighting: **10%**

On successful completion you will be able to:

- Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.
- To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.
- Interpret and draw sound conclusions from analytical chemical data obtained.
- Prepare written scientific documents at a satisfactory level.

Laboratory Work

Due: **Week4,5,6,7,8,9,10,11,12,13**

Weighting: **40%**

On successful completion you will be able to:

- Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.
- To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.
- Interpret and draw sound conclusions from analytical chemical data obtained.
- Prepare written scientific documents at a satisfactory level.
- Deliver with confidence an oral presentation on a selected topic in analytical chemistry.

Mid-Year 3-hour Examination

Due: **June 2014**

Weighting: **50%**

On successful completion you will be able to:

- Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.
- To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.
- Interpret and draw sound conclusions from analytical chemical data obtained.
- Prepare written scientific documents at a satisfactory level.

Delivery and Resources

Prescribed text:

D.A.Skoog, D.M.West, F.J.Holler, S.R.Crouch, Fundamentals of Analytical Chemistry, 9th Edition, Brooks/Cole, Thomson Learning, Inc (2014).

Recommended references (all available in University Library)

D.C.Harris, Quantitative Chemical Analysis, 6th Edition, W.H.Freeman and Company (2003).

H.H.Willard, L.L.Merritt, Jr., J.A.Dean, F.A.Settle, Jr., Instrumental Methods of Analysis, 7th Edition, Wadworth Publishing Company (1988).

D.A.Skoog, F.J.Holler and T.A.Nieman, Principles of Instrumental Analysis, 5th Edition, Saunders College Publishing (1998).

Student Support Services

Macquarie University provides a range of Academic Student Support Services. Details of these services can be accessed at <http://www.students.mq.edu.au>.

Unit Schedule

DateTimeActivity

March 39:00 – 10:30Outline of Unit

Calibration Methods

11:00 – 1:00Voltammetry

2:00 – 4:00Information Retrieval

March 109:00 – 1:00Laboratory Session

2:00 – 3:30Voltammetry

4:00 – 5:30Voltammetry

TUTORIAL SET 1 ON VOLTAMMETRY

ASSIGNMENT 1 DUE AT 6 PM, MARCH 25, 2014

March 179:00 – 1:00Laboratory Session

2:00 – 3:30Voltammetry

4:00 – 5:30Voltammetry

March 249:00 – 1:00Laboratory Session

2:00 – 3:30Atomic Absorption Spectroscopy

4:00 – 5:30Atomic Absorption Spectroscopy

TUTORIAL SET 2 ON ATOMIC ABSORPTION SPECTROSCOPY

March 259:00 – 1:00Laboratory Session

2:00 – 3:30Electrophoresis

4:00 – 5:30Electrophoresis

TUTORIAL SET 3 ON ELECTROPHORESIS

March 319:00 – 1:00Laboratory Session

2:00 – 3:30Mass Spectroscopy

4:00 – 5:30Mass Spectroscopy

ASSIGNMENT 2 DUE AT 6 PM, APRIL 14, 2014

April 79:00 – 1:00Laboratory Session

2:00 – 3:30Mass Spectroscopy

4:00 – 5:30Chromatography

Tutorial Set 4 on Mass Spectroscopy

April 289:00 – 1:00Laboratory Session

2:00 – 3:30Chromatography

4:00 – 5:30Chromatography

TUTORIAL SET 4 ON CHROMATOGRAPHY

Assignment 3 due at 6 pm, May 12, 2014

June 29:00 – 10:30Immunoassays

11:00 – 12:30Immunoassays

TUTORIAL SET 5 ON IMMUNOASSAYS

1:30 – 5:30Presentation of project work (CBMS825)

EXTERNAL LABORATORY VISITS: May 5, 12, 19, 26.

Classes

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

Lectures: The material presented in the lectures is important and you should not assume that all examinable material is available in the textbook or in printed notes. On the other hand, do not assume that all examinable material is to be found in the lecture notes.

Tutorial: There are no tutorial sessions in this unit.

Laboratory Work: Laboratory sessions commence in Week 2. You will undertake five

experiments in E7B 354, the 2nd / 3rd Year teaching Laboratories. A laboratory roster will be issued in Week 1 to indicate which experiments you will be undertaking.

Policies and Procedures

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

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of 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/support/student_conduct/

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

IT Help

For help with University computer systems and technology, visit <http://informatics.mq.edu.au/help/>.

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

Graduate Capabilities

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

- Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.
- To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.
- Interpret and draw sound conclusions from analytical chemical data obtained.
- Prepare written scientific documents at a satisfactory level.
- Deliver with confidence an oral presentation on a selected topic in analytical chemistry.

Assessment tasks

- Assignments
- Laboratory Work
- Mid-Year 3-hour Examination

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

- Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.
- To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.
- Interpret and draw sound conclusions from analytical chemical data obtained.
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Assessment tasks

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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.

This graduate capability is supported by:

Learning outcomes

- Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.
- To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.
- Interpret and draw sound conclusions from analytical chemical data obtained.
- Prepare written scientific documents at a satisfactory level.
- Deliver with confidence an oral presentation on a selected topic in analytical chemistry.

Assessment tasks

- Assignments
- Laboratory Work
- Mid-Year 3-hour Examination

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

- Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.
- To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.
- Interpret and draw sound conclusions from analytical chemical data obtained.
- Prepare written scientific documents at a satisfactory level.
- Deliver with confidence an oral presentation on a selected topic in analytical chemistry.

Assessment tasks

- Assignments
- Laboratory Work
- Mid-Year 3-hour Examination

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.

This graduate capability is supported by:

Learning outcomes

- Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.
- To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.
- Interpret and draw sound conclusions from analytical chemical data obtained.
- Prepare written scientific documents at a satisfactory level.
- Deliver with confidence an oral presentation on a selected topic in analytical chemistry.

Assessment tasks

- Assignments
- Laboratory Work
- Mid-Year 3-hour Examination

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

- Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.
- To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.
- Interpret and draw sound conclusions from analytical chemical data obtained.
- Prepare written scientific documents at a satisfactory level.
- Deliver with confidence an oral presentation on a selected topic in analytical chemistry.

Assessment tasks

- Assignments
- Laboratory Work
- Mid-Year 3-hour Examination

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

- Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.
- To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.

- Interpret and draw sound conclusions from analytical chemical data obtained.
- Prepare written scientific documents at a satisfactory level.
- Deliver with confidence an oral presentation on a selected topic in analytical chemistry.

Assessment tasks

- Assignments
- Laboratory Work
- Mid-Year 3-hour Examination

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

- Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.
- To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.
- Interpret and draw sound conclusions from analytical chemical data obtained.
- Prepare written scientific documents at a satisfactory level.
- Deliver with confidence an oral presentation on a selected topic in analytical chemistry.

Assessment tasks

- Assignments
- Laboratory Work
- Mid-Year 3-hour Examination

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 outcomes

- Appreciate and understand the basic principles of a range of analytical techniques commonly used in industrial and academic research.
- To be able to make a selection of an appropriate analytical technique or a combination of techniques for the analysis of targeted samples, based on the chemistry involved.
- Interpret and draw sound conclusions from analytical chemical data obtained.
- Prepare written scientific documents at a satisfactory level.
- Deliver with confidence an oral presentation on a selected topic in analytical chemistry.

Assessment tasks

- Assignments
- Laboratory Work
- Mid-Year 3-hour Examination

CBMS308 is a PACE Unit

CBMS308 has been accredited as participation and community engagement (PACE) unit from 2012 and will be running according to the PACE criteria and with support from the PACE team from 2012.

PACE units provide academic framework through which students can engage with the community, learn through participation, develop their capabilities and build on the skills that employees value. By completing a PACE unit, students develop all these skills and capabilities, and also gain academic credit towards their degree.

In PACE units, students are required to undertake a participation activity - the experiential component of a PACE unit whereby students engage with the community through participation. In CBMS308, students will conduct analytical chemistry work, under supervision, in a number of associated off-campus laboratories.

New work health and safety (WHS) laws replaced the occupational health and safety (OHS) laws in NSW on 1 January 2012. Macquarie University is committed to ensuring the Health and Safety of our students. Macquarie University has implemented stringent WHS practises and systems to manage work health and

safety risks. Whilst the responsibility for ensuring the health and safety of students rests with the University, students also have a responsibility to ensure that they comply with WHS policies and that their acts do not cause harm to themselves or others. Students should also be aware that these considerations extend beyond the classroom to their PACE activities and all engagement with the community.

A PACE activity is an experiential activity allocated to, and undertaken by, a student within a PACE unit that may take place in premises other than the University (usually the premises of the Partner organisation). When working or studying in non-University premises, the primary responsibility for the health and safety of our students becomes that of the Partner organisation

hosting the student. However, as a student, you also have a legal responsibility under the Workplace Health and Safety Act 2011 and the Macquarie University Health and Safety Policy to ensure the health and safety of yourself and of others in the workplace. Each student has a moreal and legal responsibility for ensuring that his or her work environment is conducive to good health and safety, by:

ensuring that their work and work area is without risk to the health and safety of themselves and others

complying with the Work Health and Safety Policy and Procedures of the University and the Partner Organisation

reporting hazards and incidents as they occur in accordance with University policy

actively participating in all health and safety activities and briefing sessions (e.g. emergency evacuation procedures, site inspections, etc)

Each student is also required to advise Dr Danny Wong as soon as possible in case:

he/she feels unsafe at any stage during the PACE activity

he/she did not receive a safety induction prior to the commencement of the activity covering: First aid, Fire and emergency evacuation; and Injury/incident reporting

he/she did not receive any specialised instructions/training necessary to carry out the role

an incident/accident happens (even when reported to the Partner organisation / supervisor and managed by them)

Non-compliance with the above may result in withdrawal of the student from the PACE activity. Students should familiarise themselves with the WHS website of the University, relevant information made available through the Faculty of Science website, and that which is provided by their PACE activity supervisor and/or Dr Danny Wong.

Page 17 of 20 <http://www.hr.mq.edu.au/HealthAndSafety/OHSforStudents/OHSforStudents.html>

<http://web.science.mq.edu.au/intranet/ohs/>

Upon completing the PACE activity, students are required to reflect upon their experiences in order to consider how their studies in CBMS308 and more broadly, their CBMS degrees, relate to the applied context of Chemistry. In particular, students are given a period of two weeks to complete an assignment issued by the senior chemist in each of the off-campus laboratories. This assignment consists of questions covering all aspects of the work performed in the laboratories, e.g. laboratory safety issues, concepts of analytical techniques used, data processing and interpretation, and appropriate action recommendations, and how these practices are relevant to their degree overall. This requires that students have a comprehensive understanding of chemistry knowledge, the ability to reflect on the work carried out, and the experience gained during their placements. Both the off-campus senior chemists and Dr Danny Wong are responsible for marking these assignments and providing feedback to students. Marks awarded are based on the quality of experimental results combined with reflective practice and they will be included in processing students' final grades and marks in CBMS308. A final

examination brings all of the unit's components together and provides students with the opportunity to make connections between their university-based learning and that achieved through participation and community engagement.

Changes since Last Offering

There are no changes made since last offering.

Technology Used

It is important that you have a scientific calculator as hand-held calculators will be used during laboratory sessions, for assignments,

and in the final examination. Note that text retrieval calculators are not allowed in the final examination.

Use will be made of Excel and other data processing and display software. Computers carrying this software are available in the teaching laboratories. Items of interest, links to other on-line material will be placed on the unitwebsite.

Computers for general use are provided by the University, but it would be advantageous to have your own computer and internet access.