



# CBMS620

## Analysis and Measurement

S2 Day 2018

*Dept of Chemistry & Biomolecular Sciences*

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#### Disclaimer

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## General Information

Unit convenor and teaching staff

Unit Convenor and Lecturer

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Credit points

4

Prerequisites

Admission to MLabQAMgt or MRadiopharmSc or MSc or MBiotech or MBioBus

Corequisites

Co-badged status

Unit description

Analysis and measurement of chemical composition is widely conducted in research and industry laboratories to support research, manufacture and production, trade, and regulatory protocols. Understanding the principles of chemical analysis and measurement is an essential part of any scientist's education. Chemical analysis involves separating molecules, determining identity, concentration and properties of analytes. This unit introduces the basic principles and approaches to undertake measurements of chemical matter in samples from across the chemical-biochemical discipline. Student will develop knowledge through lectures and tutorials and become familiar with instrumentation used to make measurements and conduct analyses in practical sessions and workshop scenarios. The unit is designed as a core component for students in chemical and biomolecular sciences.

## 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:

At the completion of this unit you will be able to demonstrate an understanding of the basic concepts of molecular analysis and measurement across the chemistry-biochemistry discipline.

Upon completion of this unit you will be able to describe the basic principles of techniques used for the analysis and measurement of inorganic and organic molecules, macromolecules and single cells.

At the completion of this unit you will be able to demonstrate an understanding of the basic principles of reaction kinetics and distinguish the need for, and uses of, separation and spectroscopic techniques.

Upon completion of this unit you will be able to demonstrate intermediate chemistry-laboratory skills and an understanding of general laboratory safety procedures.

By the unit's conclusion you will be able to interpret and draw sound conclusions from analytical chemical data obtained, and communicate conclusions based on experiments in the form of written reports.

At the completion of this unit you will be able to work in small groups and be competent in the written and oral presentation of scientific data.

## General Assessment Information

Please refer to the Macquarie University Assessment policy regarding submission of assignments, plagiarism, extensions, late submission etc.

Attendance at laboratory practicals and workshops: Please note that attendance at all 5 lab practicals and 6 workshops is **compulsory**. The laboratory component of CBMS620 is a **hurdle** requirement. There will be 10% (of the practical work) per day penalty for late submission of the report. Late submission will not be accepted after 7 days due and a mark of zero will be received. If you are unable to attend class, or hand in a form of assessment due to illness or misadventure, you must submit a Special Consideration Request at [ask.mq.edu.au](https://ask.mq.edu.au) no later than five (5) working days after the assessment task date or due date. You should also immediately contact the Unit Convenor, Dr Yuling Wang (yuling.wang@mq.edu.au).

## Assessment Tasks

Name	Weighting	Hurdle	Due
Laboratory Work	25%	Yes	Two weeks after each lab
Workshops	20%	No	Two weeks after each workshop
Online Quizzes	10%	No	Week 3, 7, 9, 12
Final 3 hour examination	45%	No	University Examination Period

### Laboratory Work

Due: **Two weeks after each lab**

Weighting: **25%**

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

There will be 5 lab practicals with each lab assessment contributes 5%.

**Pre-lab exercise:** Before each practical, you will complete the pre-lab questions, which are designed to ensure you are familiar with the topics and activities in each practical session.

This will contribute to 2.5% of your overall course mark.

**Performance in the practical:** In each practical, you conduct the experiment as directed by the student lab-notes and by your demonstrators. You will record the data and write up your observations in a lab notebook. This notebook should be available for inspection at any time, and needs to be signed-off by your demonstrator before you leave the laboratory.

This will contribute to 7.5% of your overall course mark.

**Laboratory report:** As part of each practical, you will complete a report on the experiment. Doing this will strengthen your understanding of the principles of the technique and enhance your data analysis and the scientific writing skills. A full laboratory report is required for 2 lab practicals and is due by two weeks after each lab.

This will contribute to 15% of your overall course mark.

**The laboratory component of CBMS620 is a “hurdle” requirement. That is, you must complete the laboratory component to a satisfactory level to be able to pass the unit overall, which means that the aggregate mark for your practical component must be 50% or greater of the lab practicals (25%), to allow a pass mark to be awarded for the unit.**

On successful completion you will be able to:

- At the completion of this unit you will be able to demonstrate an understanding of the

basic concepts of molecular analysis and measurement across the chemistry-biochemistry discipline.

- Upon completion of this unit you will be able to describe the basic principles of techniques used for the analysis and measurement of inorganic and organic molecules, macromolecules and single cells.
- At the completion of this unit you will be able to demonstrate an understanding of the basic principles of reaction kinetics and distinguish the need for, and uses of, separation and spectroscopic techniques.
- Upon completion of this unit you will be able to demonstrate intermediate chemistry-laboratory skills and an understanding of general laboratory safety procedures.
- By the unit's conclusion you will be able to interpret and draw sound conclusions from analytical chemical data obtained, and communicate conclusions based on experiments in the form of written reports.
- At the completion of this unit you will be able to work in small groups and be competent in the written and oral presentation of scientific data.

## Workshops

Due: **Two weeks after each workshop**

Weighting: **20%**

There will be 6 workshops in this unit. Each workshop assessment contributes 3% for 5 workshops and the sixth workshop assessment is based on a molecular project, which contributes 5%.

**Pre-workshop exercise:** Before each workshop, the pre-workshop questions are designed to ensure you are familiar with the workshop topics and the activities, and to ensure the workshop can run smoothly.

This will contribute to 1.5% of your overall course mark.

**In-class tasks:** In each workshop class, you are asked to complete 3 tasks; each task contributes 0.5%.

This will contribute to 7.5% of your overall course mark.

**Post-class tasks:** After each workshop class, there will be one task designed to enhance your understanding of the principles and applications of the technique.

This will contribute to 6% of your overall course mark.

**Molecular project:** You will choose from a list of projects provided to you, but you are encouraged to choose your own topics. You will produce a written report (weighing 3%) and give an oral presentation (weighing 2%).

This will contribute to 5% of your overall course mark.

On successful completion you will be able to:

- At the completion of this unit you will be able to demonstrate an understanding of the basic concepts of molecular analysis and measurement across the chemistry-biochemistry discipline.
- Upon completion of this unit you will be able to describe the basic principles of techniques used for the analysis and measurement of inorganic and organic molecules, macromolecules and single cells.
- At the completion of this unit you will be able to demonstrate an understanding of the basic principles of reaction kinetics and distinguish the need for, and uses of, separation and spectroscopic techniques.
- At the completion of this unit you will be able to work in small groups and be competent in the written and oral presentation of scientific data.

## Online Quizzes

Due: **Week 3, 7, 9, 12**

Weighting: **10%**

There will be four online quizzes (multiple choice + short answers) to help you understand the concepts presented in the lectures.

- Quiz 1: Data Evaluation (Week 3)
- Quiz 2: Kinetics (Week 7)
- Quiz 3: Separation (Week 9)
- Quiz 4: Spectroscopy and Imaging (Week 12)

On successful completion you will be able to:

- At the completion of this unit you will be able to demonstrate an understanding of the basic concepts of molecular analysis and measurement across the chemistry-biochemistry discipline.
- Upon completion of this unit you will be able to describe the basic principles of techniques used for the analysis and measurement of inorganic and organic molecules, macromolecules and single cells.
- At the completion of this unit you will be able to demonstrate an understanding of the basic principles of reaction kinetics and distinguish the need for, and uses of, separation and spectroscopic techniques.

## Final 3 hour examination

Due: **University Examination Period**

Weighting: **45%**

The final examination will be 3 hours in length with 10 minutes reading time. The final examination will cover all sections of the unit (lectures, lab practicals, workshops and assignments) and is designed to address specific understanding of all the concepts presented within the course.

On successful completion you will be able to:

- At the completion of this unit you will be able to demonstrate an understanding of the basic concepts of molecular analysis and measurement across the chemistry-biochemistry discipline.
- Upon completion of this unit you will be able to describe the basic principles of techniques used for the analysis and measurement of inorganic and organic molecules, macromolecules and single cells.
- At the completion of this unit you will be able to demonstrate an understanding of the basic principles of reaction kinetics and distinguish the need for, and uses of, separation and spectroscopic techniques.

## Delivery and Resources

### Classes

#### Lectures

Lectures will be presented formally. Some lecture material will be available on the unit website beforehand (in iLearn: <http://ilearn.mq.edu.au>), while other material will be provided in the lecture class. You are strongly encouraged to review the lecture material and bring it into the lecture class, so you can spend most of time engaging with the lecture and ask questions in the class if you have them. There are two one-hour lectures per week for 13 weeks. Two Revision lectures will be provided in the last week of the semester.

#### Laboratory Classes

Practical classes are designed for you to develop basic laboratory, safety and critical and analytical analysis skills. There will be 5 three-hour lab practicals run fortnightly. Laboratory notes will be available on iLearn for download, you must bring a copy with you to your laboratory class and are expected to have read through all of the planned activities. Please also bring a lab coat and laboratory notebook to your lab session.

Please note that practical classes are a **hurdle** component for this unit with medical certificates being required should a student be absent due to illness. These should be submitted online together with a disruption to studies request (special consideration), which can be found at: <http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration>.

#### Workshop Classes

Workshop classes are designed to introduce students to a range of problem-solving skills and mainly consist of material related to lab practical, lecture topics, using a series of activities, problems or questions during the workshop. There will be 6 two-hour workshops run fortnightly. Workshop notes will be available on iLearn for download, you must bring a copy with you to your workshop class and are expected to have read through all of the planned activities. Please also bring your own laptop for the workshop activities. We will provide the laptop in case you don't have one.

### **Optional Tutorial Session**

- There are no formal tutorial classes in this unit, but optional weekly online questions with answer sheet will be provided in iLearn site of this unit.
- An optional Tutorial session will be provided in **Week 12** as workshop time.

### **Required and Recommended Texts and/or Materials**

#### **Prescribed text:**

- Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Fundamentals of Analytical Chemistry, 9<sup>th</sup> Edition, Brooks/Cole, Thomson Learning, Inc (2014) (Chapters 1-8; 24-34).

#### **Recommended Textbook and/or Materials**

- D.C. Harris, Quantitative Chemical Analysis, 9<sup>th</sup> Edition, Macmillan Publishing (2015) (Chapters 0-5, 18-26).
- D. Sheehan, Physical Biochemistry: Principles and Applications, 2<sup>nd</sup> Edition, John Wiley & Sons Ltd (2009) (Chapters 2, 5).
- Book chapter on "Chemical Kinetics" (provided by Prof Alison Rodger).
- D. S. Hage, J. D. Carr, Analytical Chemistry and Quantitative Analysis, 1<sup>st</sup> Edition, Pearson (2011).

### **Technology Used and Required**

iLearn: You are expected to access the unit website on a frequent basis and download PDF files provided. You are strongly encouraged to make use the discussion forum available on the unit website for general discussion of the materials presented in this unit.

General use computers are provided by the University, but it would be advantageous to have your own computer and internet access. Microsoft Office is available free-of-charge to Macquarie University students. See <https://wiki.mq.edu.au/display/microsoftstu/About>

It is important that you have a scientific calculator as hand-held calculators will be used in practicals, workshops, for assignments, tests 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 and links to other on-line



material will be placed on the unit iLearn website.

## Unit Schedule

**Lectures** begin on the 31 July 2018 and will be held on:

Day	Time	Location
Tuesday	12-1 pm	14 Sir Christopher Ondaatje Ave (14SCO) - T4 Theatre
Wednesday	3-4 pm	23 Wallys Walk - T1 Theatre

**Laboratory practicals** start the second week of the semester and will be held on:

Session	Weeks	Day	Time	Location
1	2, 4, 6, 8, 10	Friday	9-12 pm	14SCO (E7B)-347 Teaching Lab
2	2, 4, 6, 8, 10	Friday	2-5 pm	14SCO (E7B)-347 Teaching Lab

Students will need to register for one session only.

**Workshop classes** start the third week of the semester and will be held on:

Session	Weeks	Date	Time	Location
1	3, 5, 7, 9, 11, 13	Friday	9-11 am	4WW (F7B)-322
2	3, 5, 7, 9, 11, 13	Friday	2-4 pm	4WW (F7B)-322

Students will need to register for one session only.

## 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) (<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) (<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](http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<http://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 shown in *iLearn*, 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).

## 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 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](http://ask.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.

## 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

- Upon completion of this unit you will be able to describe the basic principles of techniques used for the analysis and measurement of inorganic and organic molecules, macromolecules and single cells.
- Upon completion of this unit you will be able to demonstrate intermediate chemistry-laboratory skills and an understanding of general laboratory safety procedures.
- By the unit's conclusion you will be able to interpret and draw sound conclusions from analytical chemical data obtained, and communicate conclusions based on experiments in the form of written reports.

### 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

- By the unit's conclusion you will be able to interpret and draw sound conclusions from analytical chemical data obtained, and communicate conclusions based on experiments in the form of written reports.
- At the completion of this unit you will be able to work in small groups and be competent in the written and oral presentation of scientific data.

### Assessment tasks

- Laboratory Work
- Workshops
- Final 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

- At the completion of this unit you will be able to demonstrate an understanding of the basic concepts of molecular analysis and measurement across the chemistry-biochemistry discipline.
- Upon completion of this unit you will be able to describe the basic principles of techniques used for the analysis and measurement of inorganic and organic molecules, macromolecules and single cells.
- At the completion of this unit you will be able to demonstrate an understanding of the basic principles of reaction kinetics and distinguish the need for, and uses of, separation and spectroscopic techniques.
- Upon completion of this unit you will be able to demonstrate intermediate chemistry-laboratory skills and an understanding of general laboratory safety procedures.

### Assessment tasks

- Laboratory Work
- Workshops
- Online Quizzes
- Final 3 hour examination

## 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

- At the completion of this unit you will be able to demonstrate an understanding of the

basic concepts of molecular analysis and measurement across the chemistry-biochemistry discipline.

- Upon completion of this unit you will be able to describe the basic principles of techniques used for the analysis and measurement of inorganic and organic molecules, macromolecules and single cells.
- At the completion of this unit you will be able to demonstrate an understanding of the basic principles of reaction kinetics and distinguish the need for, and uses of, separation and spectroscopic techniques.
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- By the unit's conclusion you will be able to interpret and draw sound conclusions from analytical chemical data obtained, and communicate conclusions based on experiments in the form of written reports.

## **Assessment tasks**

- Laboratory Work
- Workshops
- Online Quizzes
- Final 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**

- At the completion of this unit you will be able to demonstrate an understanding of the basic concepts of molecular analysis and measurement across the chemistry-biochemistry discipline.
- Upon completion of this unit you will be able to describe the basic principles of techniques used for the analysis and measurement of inorganic and organic molecules, macromolecules and single cells.
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- At the completion of this unit you will be able to work in small groups and be competent in the written and oral presentation of scientific data.

## **Assessment tasks**

- Laboratory Work
- Workshops
- Online Quizzes
- Final 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**

- At the completion of this unit you will be able to demonstrate an understanding of the basic concepts of molecular analysis and measurement across the chemistry-biochemistry discipline.
- Upon completion of this unit you will be able to describe the basic principles of techniques used for the analysis and measurement of inorganic and organic molecules, macromolecules and single cells.
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- At the completion of this unit you will be able to work in small groups and be competent

in the written and oral presentation of scientific data.

## **Assessment tasks**

- Laboratory Work
- Workshops
- Online Quizzes
- Final 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**

- At the completion of this unit you will be able to demonstrate an understanding of the basic principles of reaction kinetics and distinguish the need for, and uses of, separation and spectroscopic techniques.
- At the completion of this unit you will be able to work in small groups and be competent in the written and oral presentation of scientific data.

## **Assessment tasks**

- Laboratory Work
- Workshops

## **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 outcome**

- At the completion of this unit you will be able to work in small groups and be competent in the written and oral presentation of scientific data.