



# CHEM3401

## Physical Chemistry II

Session 1, Weekday attendance, North Ryde 2020

*Department of Molecular Sciences*

### Contents

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<u>General Information</u>	2
<u>Learning Outcomes</u>	2
<u>Assessment Tasks</u>	3
<u>Delivery and Resources</u>	3
<u>Unit Schedule</u>	5
<u>Policies and Procedures</u>	6

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Unit Convenor

Ian Jamie

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Contact via 02 9850 8293

4WW 236

Open Hours

Credit points

10

Prerequisites

20cp of CBMS or BMOL or CHEM units at 2000 level or above including (CHEM2401 or CBMS200 or CBMS207)

Corequisites

Co-badged status

Unit description

This unit explores the underlying principles that govern the properties and behaviour of chemical processes. We will explore the what, why and how fast of chemistry: structure, energy, and rate. The theoretical foundations of these topics are respectively, quantum mechanics, thermodynamics, and chemical kinetics. There is an emphasis on the chemistry of global climate change; ozone depletion; dispersal and transformation of chemicals in the environment; equilibrium and non-equilibrium processes in the world's oceans; and other environmentally relevant topics.

## 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:** Explain some of the underlying molecular and quantum processes relating to spectroscopy and thermodynamics, and their applications.

**ULO2:** Solve problems in quantum mechanics (spectroscopy, group theory), thermodynamics and chemical transport, by identifying the essential parts of them, and

formulating a strategy for solving them.

**ULO3:** Rationally estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret its results.

**ULO4:** Discuss the use of models in developing theory and be able to critical analyse the strengths and weaknesses of the models used in the context of this unit.

**ULO5:** Undertake and evaluate the data from laboratory-based experiments using the fundamental concepts of physical chemistry and employing modern equipment and techniques, and use research literature to support experiment analysis, and work within the paradigm of safe laboratory practices

## Assessment Tasks

### Coronavirus (COVID-19) Update

Assessment details are no longer provided here as a result of changes due to the Coronavirus (COVID-19) pandemic.

Students should consult [iLearn](#) for revised unit information.

[Find out more about the Coronavirus \(COVID-19\) and potential impacts on staff and students](#)

## Delivery and Resources

### Coronavirus (COVID-19) Update

Any references to on-campus delivery below may no longer be relevant due to COVID-19.

Please check here for updated delivery information: [https://ask.mq.edu.au/account/pub/display/unit\\_status](https://ask.mq.edu.au/account/pub/display/unit_status)

## Classes

**Timetable:** Please check [www.timetables.mq.edu.au](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 the printed notes. On the other hand, do not assume that all examinable material is to be found in the lecture notes.

**Tutorial:** Tutorial problems, which may form part of the material submitted for assessment, will be distributed by the lecturer.

**Laboratory Work:** You will undertake practicals both at the bench (wet-labs) and in the "write-up room" dry-lab workshops.

A laboratory roster will be issued to indicate which experiments you will be undertaking in which week.

Before commencing a new experiment you are required to complete a laboratory preparation exercise. You must have the pre-lab exercises checked by a lecturer BEFORE the lab session starts. You will not be allowed to commence the experimental work until the preparation exercise is completed in a satisfactory manner. A delay in starting the experimental work due to poor pre-lab preparation may have a detrimental effect on your ability to perform the laboratory work. You should attempt the pre-lab exercises well in advance of each practical class. You are advised to carefully read the notes for each experiment.

Students unable to attend laboratory classes due to illness or misadventure (as defined in the Handbook of Undergraduate Studies) and who are unable to catch up in a reserve session must provide formal documentary evidence to the University as soon as possible after the absence, via the Special Consideration mechanism (see <https://students.mq.edu.au/study/my-study-program/special-consideration>). For any unjustified absences, a mark of zero will be given.

Some practical work may be undertaken before the corresponding material has been covered in lectures. The notes have been written with this in mind and some allowance will be made in the marking of reports.

Reports must be submitted no later than 6 pm on the day of the next practical session, except for the last practical report, which will be due 14 days after the practical session. Penalties for late submission will accumulate at 10% per day overdue. Reports are to be **word-processed and submitted via iLearn**. All supplementary files (spreadsheets, spectra, etc) are to be uploaded along with the report.

## Required and Recommended Texts and/or Materials

Recommended Text Book: Atkins & de Paula "Elements of Physical Chemistry" 7th Ed, Oxford University Press is recommended. The larger "Atkins' Physical Chemistry" 11th ed, Oxford University Press is better but more expensive. The 10th edition is also acceptable.

Recommended Supplementary Text: Monk "Maths for Chemistry: a Chemist's Toolkit of Calculations" or some equivalent book might be useful.

Alternative Text Books: Raymond Chang "Physical Chemistry for the Chemical and Biological Sciences", 3rd ed, University Science Books (2000) is reasonable, and somewhat more readable than "Physical Chemistry", but is a bit light in the spectroscopy section. Some students find "Physical Chemistry" by R.A. Alberty and R.J. Silbey provides readable introductions to some topics but is less helpful when it comes to problem-solving. Two older books that can provide an alternative introduction to aspects of molecular spectroscopy are "Fundamentals of Molecular Spectroscopy" by C.N. Banwell and "Introduction to Molecular Spectroscopy" by G. M. Barrow. You can find several textbooks with "Physical 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.

Texts entitled *Environmental Chemistry* or similar tend to be too broad with respect to the chemistry, and there is limited depth of discussions on Physical Chemistry aspects. However, good background information on the broader aspects of Chemistry in the environmental context can be obtained from these texts. Examples of good Environmental Chemistry texts are S.E. Manahan "Environmental Chemistry" (TD193.M36), G.W. VanLoon and S.J. Duffy

"Environmental Chemistry: A Global Perspective" (TD193 .V36) and C. Baird and M. Cann  
"Environmental Chemistry" (TO192 .B35)

There are 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

Your reports will be submitted electronically (through iLearn), so it is important that you have access to a word processor, and the ability to manipulate PDF files.

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. While spreadsheets are recommended for most calculations, it is important that you have a scientific calculator as these will be used in the final examination. Note that text-retrieval calculators are not allowed in the final examination.

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>

**Unit Web Page:** The URL of the CHEM3401 web site is: [ilearn.mq.edu.au](http://ilearn.mq.edu.au). You will be asked for a username and password. Your username is your student MQID. Your MQID and password have been mailed to you by the University. If you have lost them go to the student portal: [my.mq.edu.au](http://my.mq.edu.au)

## Unit Schedule

### Coronavirus (COVID-19) Update

The unit schedule/topics and any references to on-campus delivery below may no longer be relevant due to COVID-19. Please consult [iLearn](#) for latest details, and check here for updated delivery information: [https://ask.mq.edu.au/account/pub/display/unit\\_status](https://ask.mq.edu.au/account/pub/display/unit_status)

The schedule below is tentative and may change as circumstances require.

A timetable and syllabus will be handed out in the first week.

Tutorials will commence in Week 1.

Workshops/Practicals will start in Week 2.

	Lecture	Tutorial	Pracs	Assignments & Tests
	Wednesday	Wednesday	Thursday	

MQ Week Num	Week starting	11 Wallys Wlk - 160 Tutorial Rm 12:00 noon – 2:00 pm	14 Eastern Rd - 386 Tutorial Rm 2:00 pm – 3:00 pm	14 SCOA - 346/347 2:00 - 6:00 pm	
1	24-Feb-20	Spectroscopy	Spectroscopy	-	
2	2-Mar-20	Spectroscopy	Spectroscopy	Workshop - Data Analysis	
3	9-Mar-20	Spectroscopy	Spectroscopy	FTIR - CO Group A	
4	16-Mar-20	Spectroscopy	Spectroscopy	FTIR - CO Group B	
5	23-Mar-20	Spectroscopy	Spectroscopy	UV-Vis - I <sub>2</sub> /Dyes Group A	
6	30-Mar-20	Spectroscopy	Spectroscopy	UV-Vis - I <sub>2</sub> /Dyes Group B	
7	6-Apr-20	Thermodynamics	Thermodynamics	Molecular Symmetry Group A	Spectroscopy Test
	13-Apr-20	Recess		Recess	Recess
	20-Apr-20				
8	27-Apr-20	Thermodynamics	Thermodynamics	Molecular Symmetry Group B	Spectroscopy Assignment Due
9	4-May-20	Thermodynamics	Thermodynamics	Thermo Think-In Group A	
10	11-May-20	Thermodynamics	Thermodynamics	Thermo Think-In Group B	
11	18-May-20	Transport and Fate	Transport and Fate	TBA Group A	Thermodynamics Test
12	25-May-20	Transport and Fate	Transport and Fate	TBA Group B	Thermodynamics Assignment Due
13	1-Jun-20	Revision	Revision		

## 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.*)

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 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.