CBMS207

Physical and Environmental Chemistry I

S1 Day 2014

Chemistry and Biomolecular Sciences

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
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F7B 236
Anytime

Lecturer
Christopher McRae
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Students are encouraged to arrange a meeting via email.

Credit points
3

Prerequisites
CBMS101(Cr) or CBMS102

Corequisites

Co-badged status

Unit description
Environmental issues are of foremost concern in the world today. The environment depends on complex interactions of chemical and physical processes. In this unit these processes are explored through the study of the underlying principles that govern the properties and behaviour of chemical systems. Physical chemistry permeates all of modern chemistry and many adjoining areas such as biomolecular sciences, materials science and environmental science. Using environmental chemistry examples and contexts, we explore the what, why and how fast of chemistry: structure, energy and rate. These topics are examined in terms of the origin, transport and fate of chemicals in the biosphere, atmosphere, hydrosphere and lithosphere.

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 explain the underlying molecular and quantum processes relating to kinetics, quantum mechanics (spectroscopy, thermodynamics) and their application to environmental areas. You will be able to connect these chemistry concepts to climate forcing, ozone depletion, transport and degradation of chemicals in the environment.

Upon completion of this unit you will be able to solve problems in kinetics, quantum mechanics (spectroscopy), thermodynamics and chemical transport, by identifying the essential parts of, and formulating a strategy for solving, them. You will be able to rationally estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret their results.

By the unit's conclusion you will be able to 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.

At the completion of this unit you will be able to communicate conclusions based on experiments in the form of written reports.

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

At the completion of this unit you will be able to collect, record and analyse experimental data, describing the numerical significance of experimental results and the source and significance of uncertainty in scientific investigations.

Assessment Tasks

Name	Weighting	Due
Practicals	20%	1 Week after Prac
Assignment 1	7%	Week 5
Assignment 2	7%	Week 9
Assignment 3	6%	Week 13
In-Semester Test 1	5%	9-April-2014
In-Semester Test 2	5%	29-May-2014

Name	Weighting	Due
Final Examination	50%	Examination Period

Practicals

Due: **1 Week after Prac**
Weighting: **20%**

Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.

On successful completion you will be able to:

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Assignment 1

Due: **Week 5**

Weighting: **7%**

Three small assignments will be issued.

Assignment questions are issued so that you will have the opportunity to use the information provided in the lectures and textbook to test your degree of understanding of those topics.

On successful completion you will be able to:

- At the completion of this unit you will be able to explain the underlying molecular and quantum processes relating to kinetics, quantum mechanics (spectroscopy, thermodynamics) and their application to environmental areas. You will be able to connect these chemistry concepts to climate forcing, ozone depletion, transport and degradation of chemicals in the environment.
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Assignment 2

Due: **Week 9**
Weighting: **7%**

Three small assignments will be issued.

Assignment questions are issued so that you will have the opportunity to use the information provided in the lectures and textbook to test your degree of understanding of those topics.

On successful completion you will be able to:

- At the completion of this unit you will be able to explain the underlying molecular and quantum processes relating to kinetics, quantum mechanics (spectroscopy, thermodynamics) and their application to environmental areas. You will be able to

connect these chemistry concepts to climate forcing, ozone depletion, transport and degradation of chemicals in the environment.
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Assignment 3

Due: **Week 13**
Weighting: **6%**

Three small assignments will be issued.

Assignment questions are issued so that you will have the opportunity to use the information provided in the lectures and textbook to test your degree of understanding of those topics.

On successful completion you will be able to:

- At the completion of this unit you will be able to explain the underlying molecular and quantum processes relating to kinetics, quantum mechanics (spectroscopy, thermodynamics) and their application to environmental areas. You will be able to connect these chemistry concepts to climate forcing, ozone depletion, transport and degradation of chemicals in the environment.
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In-Semester Test 1

Due: **9-April-2014**
Weighting: **5%**

Two in-semester tests are conducted after the first two major sections, Kintics and Spectroscopy. The intention of these tests is to allow you to consolidate your learning of those sections of the course so that at the end of semester you will be able to concentrate your preparation for the final exam on the later sections of the course. The tests also provide you with a measure of your understanding of those sections and will direct you to areas that you need to spend more time on.

On successful completion you will be able to:

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In-Semester Test 2

Due: **29-May-2014**
Weighting: **5%**

Two in-semester tests are conducted after the first two major sections, Kintics and Spectroscopy. The intention of these tests is to allow you to consolidate your learning of those sections of the course so that at the end of semester you will be able to concentrate your preparation for the

final exam on the later sections of the course. The tests also provide you with a measure of your understanding of those sections and will direct you to areas that you need to spend more time on.

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Final Examination

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

The final examination will be 3 hours in length and will cover all sections of the unit (lectures, tutorials, assignments and laboratory exercises).

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Delivery and Resources

Office Hours

There are no formal office hours for this unit. Dr Jamie and Dr McRae are happy to receive students outside of the formal lecture and tutorial 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.

Required and Recommended texts and/or materials

Recommended Text Book: For those continuing to CBMS307, we recommend that you obtain **Atkins & de Paula** "**Atkins' Physical Chemistry**" **9th ed**, Oxford University Press (2006). The 8th edition is also acceptable.

For those students not continuing to CBMS307, the smaller text, **Atkins & de Paula** "**The Elements of Physical Chemistry**"**, 6th ed**, Oxford University Press (2005) is suitable. The 5th edition is also acceptable.

Recommended Supplementary Text: The Library and the University Co-Op Bookshop carries copies of **Monk** "**Maths for Chemistry: a Chemist's Toolkit of Calculations**". This text might be of use to you if you wish to revise some mathematics.

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 "Atkins' Physical Chemistry", but a bit light in the spectroscopy section. Some students find "Physical Chemistry" by Alberty, Silbey and Bawendi provides readable introductions to some topics, but is less helpful when it comes to problem solving. The library also carries older editions without Bawendi as a co-author.

Your first-year textbook and lecture notes may be referred to in the lectures on molecular spectroscopy and the second year textbook "Organic Chemistry" by J. McMurry may also be referred to on occasion.

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

You can find a number of 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. 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.

Text titled “Environmental Chemistry” or similar tend to be too broad with respect to the chemistry, so the depth of the discussions on the Physical Chemistry aspects tends to be restricted. However, good background information on the broader aspects of chemistry in the environmental context can be obtained from these texts.

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

It is important that you have a scientific calculator as hand-held calculators will be used in tutorials, practicals, for assignments, tests and in the final examination. Note that text-retrieval calculators are not allowed in the in-semester tests or 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 and iLectures will be placed on the unit Blackboard website.

A piece of software from Microsoft called Microsoft Mathematics, might be of use. It is a sophisticated graphical calculator, equation solver and data provider. It can solve calculus problems and provide many of the commonly used equations, operations and constants. installing in January, the software seemed to be a little temperamental but useable. There is an add-on for Microsoft Windows (2007 and later). Do a web search using the search term “Microsoft Mathematics”.

General use computers are provided by the University, but it would be advantageous to have your own computer and internet access. During lab sessions you will be using provided laptops or desktops computers to acquire, process and analyse data. Data processing and analysis will be done primarily with Excel. While it is not required, most students will want to generate their reports using a word processor. In some respects, hand-written reports will be easier to generate, but it is your decision as to the method that you use.

Classes

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

Lectures and Tutorials: There will be some overlap between the lectures and tutorial, in that the lectures are expected to be intereactive and have time for problem solving.

All of 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.

Workshops and Laboratory Work: The total mark allocation for laboratory work is 20%. You must complete this component of the course satisfactorily to be able to pass the unit overall.

Workshops and laboratory sessions commence in Week 2. You will undertake six experiments at the bench (wet-labs) and one dry-lab workshop. The wet-labs are held in E7B 348/349/350. The dry-lab will deal with data analysis and error propagation.

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

The wet-labs will be run approximately every second week. You are encouraged to use your “off-week” to continue your data analysis and write-up. It may be possible to arrange for you to have access to the instruments and/or data, but it will not be possible for you to continue “wet-work” in the off-week. Any “off-week” afternoons when you have no assigned laboratory work should be devoted to report writing.

Before commencing a new experiment you are **required to complete the prelab questions**. All questions are to be answered on the worksheet provided with the prac notes and are to be signed-off by the lecturer at the start of the lab class. A random subset of these questions is to be answered online as a iLearn quiz, no later than one hour before the commencement of the class. 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 satisfactorily. You should attempt the pre-lab exercises well in advance of each practical class. You are advised to read each experiment carefully.

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 another session must provide formal documentary evidence to the University as soon as possible after the absence. For one such justified absence students will receive the average mark from the sessions that they did attend. For any unjustified absences students will receive a zero mark and may be liable to compulsory withdrawal from the unit. You will need to submit a “special consideration form”, information on which is given below. It may be possible to rearrange your schedule if sufficient advance notice is given and if the reason for the rearrangement is reasonable. If the absence is anticipatable, such as for religious observance days and the like, it is your responsibility to discuss this with your lecturer ***in advance o***f the absence.

Some practical work will 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.

Due Date: Reports must be submitted no later than 5 pm, usually 14 days after completion of the lab but this does vary. This generally means that the prac report will be handed in at the next lab session. Penalties for late submission will accumulate at the rate of 10% per day overdue.

Unit Schedule

This Unit Schedule may be altered according to circumstances.

			Lecture Wednesday	Lecture Thursday	Tutorial Tuesday/ Thursday		Practical Wednesday	Practical Thursday
MQ Week Num	Week starting		E7B 164 9:00 – 10:00 am	E7B 164 10:00 – 11:00 pm			E7B 349 2:00 - 6:00 pm	E7B 349 2:00 - 6:00 pm
1	3-Mar-14		Empirical Kinetics	Empirical Kinetics	Kinetics		-	-
2	10-Mar-14		Molecular Basis of Kinetics	Molecular Basis of Kinetics	Kinetics		Data Analysis Workshop	Data Analysis Workshop
3	17-Mar-14		Reaction Mechanisms	Reaction Mechanisms	Kinetics		Kin 1 (Wed A)	Kin 1 (Thu A)
4	24-Mar-14		Photochemistry	Collision Theory	Kinetics		Kin 1 (Wed B)	Kin 1 (Thu B)
5	31-Mar-14		Principles of Spectroscopy	Principles of Spectroscopy	Spectroscopy		Kin 2 (Wed A)	Kin 2 (Thu A)
6	7-Apr-14		Test	Rotational Spectroscopy	Spectroscopy		Kin 2 (Wed B)	Kin 2 (Thu B)
	14-Apr-14		Recess	Recess	Recess		Recess	Recess
	21-Apr-14		Recess	Recess	Recess		Recess	Recess
7	28-Apr-14		Vibrational Spectroscopy - Diatomics	Rotational Fine Structure & Polyatomics	Spectroscopy		Infrared (Wed A)	Infrared (Thu A)
8	5-May-14		Rotational Fine Structure & Polyatomics	UV-Visible Spectroscopy	Spectroscopy		Infrared (Wed B)	Infrared (Thu B)
9	12-May-14		UV-Visible Spectroscopy	Thermodynamics	Spectroscopy		UV-Vis (Wed A)	UV-Vis (Thu A)
10	19-May-14		Thermodynamics	Thermodynamics	Thermodynamics		UV-Vis (Wed B)	UV-Vis (Thu B)
11	26-May-14		Thermodynamics	Test	Transport and Fate		Particle Size (Wed A)	Particle Size (Thu A)
12	2-Jun-14		Transport and Fate	Transport and Fate	Transport and Fate		Particle Size (Wed B)	Particle Size (Thu B)
13	9-Jun-14		Transport and Fate	Transport and Fate	Spare/Revision		Thermo W/S (Wed A&B)	Thermo W/S (Thu A & B)

Learning and Teaching Activities

Practicals

Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.

Lectures/Tutorials

The lecture/tutorials will be run in a largely “active learning” mode, which means that after a brief introduction to the topic you will work through exercises designed to deepen your understanding of the subject. You are required to attend the lecture/tutorials and laboratory classes. You are expected to be active participants in all these fora. This means that you are expected to ask questions during lectures and, particularly, at tutorials and laboratory classes. Learning is an active process, and as such, you must engage with the material. This means reading the text book (and beyond) before and after lectures, attempting the assignment questions and other questions, discuss the concepts with your classmates and lecturers. Do not be afraid to ask questions – your classmates will probably want to ask the same thing.

Assignments

Assignment questions are issued so that you will have the opportunity to use the information provided in the lectures and textbook to test your degree of understanding of those topics. The assignments are designed to help you learn the material during the semester, rather than trying to cram on the day before the examination. They are relatively low risk (a small component of the aggregate score) but they are very valuable for you as measures of your understanding of the topics.

In-Semester Tests

The in-semester tests are designed to help you learn the material during the semester, rather than trying to cram on the day before the examination. They are relatively low risk (a small component of the aggregate score) but they are very valuable for you as measures of your understanding of the topics.

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 outcome

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

Assessment tasks

- Practicals
- Assignment 2
- Assignment 3
- In-Semester Test 1
- In-Semester Test 2
- Final Examination

Learning and teaching activities

- Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.
- The lecture/tutorials will be run in a largely “active learning” mode, which means that after a brief introduction to the topic you will work through exercises designed to deepen your understanding of the subject. You are required to attend the lecture/tutorials and laboratory classes. You are expected to be active participants in all these fora. This means that you are expected to ask questions during lectures and, particularly, at tutorials and laboratory classes. Learning is an active process, and as such, you must engage with the material. This means reading the text book (and beyond) before and after lectures, attempting the assignment questions and other questions, discuss the concepts with your classmates and lecturers. Do not be afraid to ask questions – your classmates will probably want to ask the same thing.

- Assignment questions are issued so that you will have the opportunity to use the information provided in the lectures and textbook to test your degree of understanding of those topics. The assignments are designed to help you learn the material during the semester, rather than trying to cram on the day before the examination. They are relatively low risk (a small component of the aggregate score) but they are very valuable for you as measures of your understanding of the topics.
- The in-semester tests are designed to help you learn the material during the semester, rather than trying to cram on the day before the examination. They are relatively low risk (a small component of the aggregate score) but they are very valuable for you as measures of your understanding of the topics.

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

- Upon completion of this unit you will be able to solve problems in kinetics, quantum mechanics (spectroscopy), thermodynamics and chemical transport, by identifying the essential parts of, and formulating a strategy for solving, them. You will be able to rationally estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret their results.
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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

- At the completion of this unit you will be able to explain the underlying molecular and quantum processes relating to kinetics, quantum mechanics (spectroscopy, thermodynamics) and their application to environmental areas. You will be able to connect these chemistry concepts to climate forcing, ozone depletion, transport and degradation of chemicals in the environment.
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- Assignment 3
- In-Semester Test 1
- In-Semester Test 2
- Final Examination

Learning and teaching activities

- Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.

- The lecture/tutorials will be run in a largely “active learning” mode, which means that after a brief introduction to the topic you will work through exercises designed to deepen your understanding of the subject. You are required to attend the lecture/tutorials and laboratory classes. You are expected to be active participants in all these fora. This means that you are expected to ask questions during lectures and, particularly, at tutorials and laboratory classes. Learning is an active process, and as such, you must engage with the material. This means reading the text book (and beyond) before and after lectures, attempting the assignment questions and other questions, discuss the concepts with your classmates and lecturers. Do not be afraid to ask questions – your classmates will probably want to ask the same thing.
- Assignment questions are issued so that you will have the opportunity to use the information provided in the lectures and textbook to test your degree of understanding of those topics. The assignments are designed to help you learn the material during the semester, rather than trying to cram on the day before the examination. They are relatively low risk (a small component of the aggregate score) but they are very valuable for you as measures of your understanding of the topics.
- The in-semester tests are designed to help you learn the material during the semester, rather than trying to cram on the day before the examination. They are relatively low risk (a small component of the aggregate score) but they are very valuable for you as measures of your understanding of the topics.

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 explain the underlying molecular and quantum processes relating to kinetics, quantum mechanics (spectroscopy, thermodynamics) and their application to environmental areas. You will be able to connect these chemistry concepts to climate forcing, ozone depletion, transport and degradation of chemicals in the environment.
- Upon completion of this unit you will be able to solve problems in kinetics, quantum mechanics (spectroscopy), thermodynamics and chemical transport, by identifying the

essential parts of, and formulating a strategy for solving, them. You will be able to rationally estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret their results.

- By the unit's conclusion you will be able to 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.
- At the completion of this unit you will be able to demonstrate intermediate chemistry-laboratory skills and an understanding of general laboratory safety procedures.
- At the completion of this unit you will be able to collect, record and analyse experimental data, describing the numerical significance of experimental results and the source and significance of uncertainty in scientific investigations.

Assessment tasks

- Practicals
- Assignment 1
- Assignment 2
- Assignment 3
- In-Semester Test 1
- In-Semester Test 2
- Final Examination

Learning and teaching activities

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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 explain the underlying molecular and quantum processes relating to kinetics, quantum mechanics (spectroscopy, thermodynamics) and their application to environmental areas. You will be able to connect these chemistry concepts to climate forcing, ozone depletion, transport and degradation of chemicals in the environment.
- Upon completion of this unit you will be able to solve problems in kinetics, quantum mechanics (spectroscopy), thermodynamics and chemical transport, by identifying the essential parts of, and formulating a strategy for solving, them. You will be able to rationally estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret their results.
- By the unit's conclusion you will be able to 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.
- At the completion of this unit you will be able to communicate conclusions based on experiments in the form of written reports.
- At the completion of this unit you will be able to demonstrate intermediate chemistry-

laboratory skills and an understanding of general laboratory safety procedures.

- At the completion of this unit you will be able to collect, record and analyse experimental data, describing the numerical significance of experimental results and the source and significance of uncertainty in scientific investigations.

Assessment tasks

- Practicals
- Assignment 1
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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 solve problems in kinetics, quantum mechanics (spectroscopy), thermodynamics and chemical transport, by identifying the essential parts of, and formulating a strategy for solving, them. You will be able to rationally estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret their results.
- By the unit's conclusion you will be able to 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.
- At the completion of this unit you will be able to communicate conclusions based on experiments in the form of written reports.
- At the completion of this unit you will be able to demonstrate intermediate chemistry-laboratory skills and an understanding of general laboratory safety procedures.
- At the completion of this unit you will be able to collect, record and analyse experimental data, describing the numerical significance of experimental results and the source and significance of uncertainty in scientific investigations.

Assessment tasks

- Practicals
- Assignment 1
- Assignment 2
- Assignment 3
- Final Examination

Learning and teaching activities

- Laboratory exercises are designed to provide a concrete example of the abstract topics covered in the course work, and to give you the opportunity to discover the principles

and applications for yourself. Laboratory exercises also offer the opportunity to explore the uncertainty inherent in scientific investigations and the limitations of models and theories by allowing comparison with real systems.

- The lecture/tutorials will be run in a largely “active learning” mode, which means that after a brief introduction to the topic you will work through exercises designed to deepen your understanding of the subject. You are required to attend the lecture/tutorials and laboratory classes. You are expected to be active participants in all these fora. This means that you are expected to ask questions during lectures and, particularly, at tutorials and laboratory classes. Learning is an active process, and as such, you must engage with the material. This means reading the text book (and beyond) before and after lectures, attempting the assignment questions and other questions, discuss the concepts with your classmates and lecturers. Do not be afraid to ask questions – your classmates will probably want to ask the same thing.
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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

- By the unit’s conclusion you will be able to 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.
- At the completion of this unit you will be able to communicate conclusions based on

experiments in the form of written reports.

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

Assessment tasks

- Practicals
- Assignment 1
- Assignment 2
- Assignment 3
- Final Examination

Learning and teaching activities

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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

- At the completion of this unit you will be able to explain the underlying molecular and quantum processes relating to kinetics, quantum mechanics (spectroscopy, thermodynamics) and their application to environmental areas. You will be able to connect these chemistry concepts to climate forcing, ozone depletion, transport and degradation of chemicals in the environment.
- At the completion of this unit you will be able to communicate conclusions based on experiments in the form of written reports.
- At the completion of this unit you will be able to demonstrate intermediate chemistry-laboratory skills and an understanding of general laboratory safety procedures.

Assessment task

- Practicals

Learning and teaching activity

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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 outcomes

- At the completion of this unit you will be able to explain the underlying molecular and quantum processes relating to kinetics, quantum mechanics (spectroscopy, thermodynamics) and their application to environmental areas. You will be able to connect these chemistry concepts to climate forcing, ozone depletion, transport and degradation of chemicals in the environment.
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Assessment tasks

- Practicals
- Final Examination

Learning and teaching activities

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classmates will probably want to ask the same thing.

Assessment Description

The grades that you achieve at Macquarie University are descriptive rather than numeric. The assessments and conditions on your performance (attendance, completion, etc) help to decide which of these descriptive grades applies to your work for the entire unit.

Your raw marks from assessments are combined into a weighted sum. The weighted sums for the whole class are ranked, and compared with rankings for the same unit in previous offerings and across other appropriate units for consistency. This process of comparison allows for the identification any unusual influences on class performance that might warrant the weighted sums of marks being scaled or otherwise altered. The numerical cut-offs for each descriptive grade are then determined. The numerical grade that you will be issued with (the Standardised Numerical Grade, SNG) is determined to match your descriptive grade by standardising the weighted sums of raw marks to match standard scores out of 100. The SNG gives you an indication of how you have performed within the band for your descriptive grade. As the SNG is the result of scaling the weighted sum of your raw marks, you will not be able to:

1. work out your exam mark based on the assignment marks you already know and the SNG;
2. determine that you were "one mark away" from a different grade.

It is our professional responsibility as your teachers to assign you a descriptive grade that accurately reflects your performance in a unit. Our grading decisions are subject to scrutiny from our academic colleagues within the Department, as well as within the Faculty and University Senate.

The Grades range from High Distinction to Fail, and are defined in the Handbook as follows:

Grade	SNG	Description
HD High Distinction	85-100	Work of outstanding quality. This may be demonstrated in areas such as criticism, logical argument, interpretation of materials or use of methodology. This grade may also be awarded to recognise a high order of originality or creativity in student performance
D Distinction	75-84	Work of superior quality in the same areas of performance as above. This grade may also be awarded to recognise particular originality or creativity in student performance
Cr Credit	65-74	Work of predominantly good quality, demonstrating a sound grasp of content together with efficient organisation, selectivity and use of techniques
P Pass	50-64	Satisfactory achievement of unit objectives

F Fail	0-49	Failure to achieve unit objectives.

Changes from the Previous Offering

There have been no signiicant changes to the unit from the pervious offering of it.

Textbook

Required and Recommended texts and/or materials

Recommended Text Book: For those continuing to CBMS307, we recommend that you obtain **Atkins & de Paula** "**Atkins' Physical Chemistry**" **9th ed**, Oxford University Press (2006). The 8th edition is also acceptable.

For those students not continuing to CBMS307, the smaller text, **Atkins & de Paula** "**The Elements of Physical Chemistry**"**, 6th ed**, Oxford University Press (2005) is suitable. The 5th edition is also acceptable.

Recommended Supplementary Text: The Library and the University Co-Op Bookshop carries copies of **Monk** "**Maths for Chemistry: a Chemist's Toolkit of Calculations**". This text might be of use to you if you wish to revise some mathematics.

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 "Atkins' Physical Chemistry", but a bit light in the spectroscopy section. Some students find "Physical Chemistry" by Alberty, Silbey and Bawendi provides readable introductions to some topics, but is less helpful when it comes to problem solving. The library also carries older editions without Bawendi as a co-author.

Your first-year textbook and lecture notes may be referred to in the lectures on molecular spectroscopy and the second year textbook "Organic Chemistry" by J. McMurry may also be referred to on occasion.

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

You can find a number of 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. 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.

Text titled "Environmental Chemistry" or similar tend to be too broad with respect to the chemistry, so the depth of the discussions on the Physical Chemistry aspects tends to be restricted. However, good background information on the broader aspects of chemistry in the environmental context can be obtained from these texts.

There also many web resources, but material placed on the web is not necessarily checked for accuracy, so be careful when using it.

Unit Website and Facebook Group

Unit web Site

The official CBMS207 website is on iLearn (ilearn.mq.edu.au)

You will be asked for a username and password. Your username is your student number.

If you have trouble logging in flow the help instructions given on the web page before contacting your lecturer academic staff. You may also contact the Help Desk:

Phone: 9850-HELP (4357)

Freecall: 1800 063 191

Email: http://help.mq.edu.au/

An unofficial Facebook group has been set up. The group name is "**CBMS207 2013**", with the e-mail address of **CBMS207.2014@groups.facebook.com** and URL of "**www.facebook.com/groups/CBMS207.2014/**". You are encouraged to use this for discussions relating the CBMS207 and exchanging information, but note that the group will be monitored by the unit convenor and also note that all official information and material will be placed on the iLearn site or conducted through your official Macquarie University email address. You will need to be invited into the group, so please send an e-mail to the group address or to the unit convenor. Include in the e-mail the e-mail address that you use to log into Facebook so that the invitation can be extended to you.