



# CBMS234

## Alchemy, Drugs and the Quest for Immortality

S3 External 2014

*Chemistry and Biomolecular Sciences*

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#### Disclaimer

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

## General Information

Unit convenor and teaching staff

Unit Convenor

Christopher McRae

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Contact via [christopher.mcrae@mq.edu.au](mailto:christopher.mcrae@mq.edu.au)

F7B 328

Students are encouraged to arrange a meeting via email.

Credit points

3

Prerequisites

15cp or admission to GCertBiotech

Corequisites

Co-badged status

CBMS123

Unit description

Alchemy is the art and science of converting one substance into another and it has been an important factor in shaping our society. Metals, ceramics, drugs and plastics have changed and enhanced our lifestyle. Drugs, fertilisers and pesticides have saved millions of lives, but not without some unforeseen environmental or social problems. When this happens, decisions have to be made and costs weighed against benefits. An appreciation of such issues is needed for better understanding of important problems that face society. This unit explores the way chemistry affects our lives, and the way chemists work things out. The unit does not aim to teach chemistry but looks at the impact that chemical sciences has had on civilisation, and where the latest molecular innovations are likely to lead us. The commercial significance of key biological processes and industries is addressed, emphasising the Australian context. The unit also examines connections between chemistry and other scientific fields as diverse as psychology, finance, medicine, environmental studies and astronomy, as well as revealing aesthetic and philosophical aspects of chemistry. This unit is taught online with a combination of topical lectures and multimedia material.

## 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:

To appreciate the role of chemistry in the history of the universe, world and society

Integrate your previous experiences and knowledge into a chemical framework

Appreciate the role of the chemist in human history and modern society, now and into the future

## General Assessment Information

Although the assessment tasks for CBMS234 are identical to those of CBMS123, CBMS123 and CBMS234 students will be graded as two separate cohorts, **with a higher standard expected for CBMS234**

### Deadlines

The deadline for submission of each assignment (W1-W5, E1-E2) is clearly defined on the timetable. Marks will be deducted for late submission (at 10% per day, unless formal justification is provided through the student centre – See Special Consideration Requests in the next section). Students need to work steadily on each assignment, aiming to finish preparation well in advance of its submission deadline.

All assignments (Essays & Workshops) are due in electronic form not later than 9 am on the submission date.

### University Policy on Grading

Academic Senate has a set of guidelines on the distribution of grades across the range from fail to high distinction based on the level of understanding and comprehension achieved. See: <http://mq.edu.au/policy/docs/grading/policy.html> for details of this policy.

The raw aggregate mark for the unit (i.e., the total of marks from all assessment items) is **not the same as the SNG**. Results will be scaled to ensure that there is a degree of consistency between the final SNG and student attainment. University policy does not require that a minimum number of students are to be failed or passed in any unit. The process of scaling will never change the ranking order among students. As a very rough guide, in this unit, you will need to achieve about 55 raw marks for a Pass, 69 for a Credit, 79 for a Distinction and 84 for a High Distinction. These numbers vary only slightly from year to year and will be converted to an SNG by application of a normalised distribution. Irrespective of your raw aggregate mark you must submit satisfactory efforts for ALL assessment tasks to pass CBMS123/234.

### Extension and Special Consideration Requests

The University recognises that there may be circumstances where a student is prevented by unavoidable disruption from performing in accordance with their ability. The University has a policy on special consideration request that may be found at: [http://www.mq.edu.au/policy/docs/special\\_consideration/policy.html](http://www.mq.edu.au/policy/docs/special_consideration/policy.html)

You will need to lodge your request for special consideration by doing the following:

1. Log onto Ask.MQ (<http://ask.mq.edu.au/>)
2. Go to "My Enquiries"
3. Login with your OneID
4. Under "Forms and Requests", select "Submit request for Special Considerations" from the drop-down menu
5. Fill in your relevant details
6. Attach supporting document by clicking "Add a reply", click "Browse" and add scanned documents
7. Take the original supporting documentation to be sighted at your faculty office.

## Assessment Tasks

Name	Weighting	Due
<b>W1</b> .....	10%	12/12/14
<b>W2</b> .....	10%	19/12/14
<b>W3</b> .....	10%	02/01/15
<b>W4</b> .....	10%	09/01/15
<b>W5</b> .....	10%	23/01/15
<b>E1</b> .....	25%	24/12/14
<b>E2</b> .....	25%	16/01/15

### W1

Due: **12/12/14**

Weighting: **10%**

20 multiple choice questions

On successful completion you will be able to:

- To appreciate the role of chemistry in the history of the universe, world and society
- Appreciate the role of the chemist in human history and modern society, now and into the future

### W2

Due: **19/12/14**

Weighting: **10%**

20 multiple choice questions

On successful completion you will be able to:

- To appreciate the role of chemistry in the history of the universe, world and society

## W3

Due: **02/01/15**

Weighting: **10%**

20 multiple choice questions

On successful completion you will be able to:

- To appreciate the role of chemistry in the history of the universe, world and society

## W4

Due: **09/01/15**

Weighting: **10%**

20 multiple choice questions

On successful completion you will be able to:

- To appreciate the role of chemistry in the history of the universe, world and society
- Appreciate the role of the chemist in human history and modern society, now and into the future

## W5

Due: **23/01/15**

Weighting: **10%**

20 multiple choice questions

On successful completion you will be able to:

- To appreciate the role of chemistry in the history of the universe, world and society
- Appreciate the role of the chemist in human history and modern society, now and into the future

## E1

Due: **24/12/14**

Weighting: **25%**

Write a 2000 word essay on a chosen Book Chapter *or* a Chemical Industry

On successful completion you will be able to:

- To appreciate the role of chemistry in the history of the universe, world and society
- Appreciate the role of the chemist in human history and modern society, now and into the future

## E2

Due: **16/01/15**

Weighting: **25%**

Write a Poem about Chemistry and then a 2000 word critique of your poem or write a 2000 word essay on the philosophy of science if it had been written by chemists.

On successful completion you will be able to:

- To appreciate the role of chemistry in the history of the universe, world and society
- Integrate your previous experiences and knowledge into a chemical framework

## Delivery and Resources

### Teaching and Learning Strategy

The CBMS123/234 unit website, at <http://ilearn.mq.edu.au>, allows you access to lecture notes and other resources. **To log in, use your Student OneID *plus* your regular password.**

Lecture notes are put on the Web in advance with the audio/visual recordings (L1-L24). L0 is the orientation lecture given on the first day of semester and L23 is the Nobel Prize lecture. Both of these lectures are given live in Session 2, 2014. Any due dates or references to "Live lectures" do not apply to this session 3 version of the unit.

All students should be regularly accessing the CBMS123/234 iLearn site, which contains important information. This is a vital requirement for this unit, with its progressive assessment and no final examination. **Regular study of the e-lectures is also expected.**

**Students must submit each of their Workshops and Essay assignments in electronic form.**

### Recommended texts and/or materials

There is no textbook for CBMS123/CBMS234, however, the following books are highly recommended reading:

1. Ronald Breslow, "Chemistry. Today and Tomorrow. The Central, useful and Creative Science", (Jones and Bartlett, Sudbury, MA, 1997; ISBN 0 7637 0463 6 or ISBN 0 8412 3460 4), provides a useful foundation.
2. Arthur Greenberg, "The Art of Chemistry" (Wiley Interscience, Hoboken, 2003; ISBN

0-471-07180-3), is a beautiful book about the history and philosophy of chemistry and would make a nice coffee table book that will break the ice at parties.

3. Roald Hoffmann, "The Same and Not The Same" (Columbia UP, N.Y., 1995; ISBN 0 231 10138 4 or 0 231 10139 2), much of the lecture material is based on this book.
4. Ben Selinger, "Chemistry in the Marketplace" (Harcourt Brace, London, 5th edition, 1998; ISBN 0 349 12198 2). A homegrown Aussie book about chemistry in everyday life. A fountain of knowledge about ..... well, everything.

Additional print- and web-based material will be recommended as the unit progresses; keep an eye on the "important news" on the web page – also, see the reading list:

## Further Readings

- Susan Aldridge, *Magic Molecules - How Drugs Work* (Cambridge UP, Cambridge, 1998; ISBN 0 521 58414 0)
- Philip Ball, *The Ingredients* (Oxford University Press, Oxford, 2002, ISBN 0-19-284100-9)
- Philip Ball, *MOLECULES A Very Short Introduction*, (Oxford, 2001, ISBN 0-19-285430-5)
- Bernadette Bensaude-Vincent & Isabella Stengers, *A History of Chemistry* (Harvard University Press, Cambridge, MA, 1996; ISBN 0 674 39659 6)
- Jerome Berson. *Chemical Discovery and the Logicians' Program. A Problematic Pairing* (Wiley-VCH, Weinheim, 2003; ISBN 3 527 30797 4)
- Robert Boyle, *The Sceptical Chymist* (Dover Publications, Mineola NY, 2003, ISBN 0-486-42825-7)
- Ronald Breslow, *Enzymes, the machines of life* (Scientific Pub. Dept., Sudbury, MA, 1986; ISBN 0 8927 8155 6)
- Jacob Bronowski, *The Ascent of Man* (BBC Books, London, 1973; paperback 1976; ISBN 0 563 17064 6)
- Rachel Carson, *Silent Spring* (Penguin Books with Hamish Hamilton, Harmondsworth, 1965; ISBN 0 1400 2268 6)
- Alan Chalmers, *What is this thing called science?* (U of Queensland Press, St Lucia, 1999; ISBN 0 7022 3093 6)
- Allen G. Debus, *The Chemical Philosophy* (Dover Publications, Mineola NY, 2003, ISBN 0-486-42825-7)
- Frank W. Dobby, *The Age of the Molecule* (Harper & Row, NY, 1976, ISBN 0-06-041659-9)
- Carl Djerassi, *Oxygen: A Play in Two Acts* (Wiley-VCH, Weinheim, 2001; ISBN 3 5273

0413 4)

- John Emsley, *The Elements* (Clarendon Press, Oxford, 1998; ISBN 0 1985 5818 X)
- John Emsley, *Molecules at an Exhibition* (Oxford UP, Oxford, 1998; ISBN 0 19 850266 4)
- Simon Garfield, *Mauve: How one man invented a colour that changed the world* (Faber & Faber, London, 2000; ISBN 0 571 20197 0)
- Thomas Hager, *The alchemy of air: A Jewish genius, a doomed tycoon, and the scientific discovery that fed the world but fuelled the rise of Hitler* (Harmony Books, N.Y., 2008; ISBN ISBN 978-0-307-35178-4)
- Arthur Greenberg, *A Chemical History Tour* (Wiley-Interscience, N.Y., 2000; ISBN 0 471 35408 2)
- E. Heilbronner and F. A. Miller, *A Philatelic Ramble through Chemistry* (Wiley-VCH, Zürich, ISBN 3-906390-31-4)
- Bernard Jaffe, *Crucibles: The Story of Chemistry* 4<sup>th</sup> Ed (Dover Publications, Mineola NY, 1976, ISBN 0-486-23342-1)
- Kerry Karukstis & Gerald Van Hecke, *Chemistry Connections* (2nd Ed. Academic Press, N.Y., 2000; ISBN-13 9780124001510)
- Primo Levi, *The Periodic Table* (English translation; Michael Joseph Ltd, London, 1985; ISBN 0 349 12198 2)
- Kary B. Mullis, *Dancing Naked in the Mind Field* (Pantheon Books, N. Y., 1998; ISBN 0 6794 4255 3)
- Paul Strathern, *Mendeleev's Dream* (Hamish Hamilton, London, 2000; ISBN 0 14 028414 1)
- James Watson, *The Double Helix* (Weidenfeld and Nicolson, London, 1981; ISBN 0 297 77899 4)
- John Ziman, *Real Science* (Cambridge University Press, Cambridge, 2000 ISBN 0-521-77229-X)

Copies of some of these books (and other relevant ones) will be placed in the Reserve section of the Library.

Selected book extracts will occasionally be reproduced (to the extent permissible by copyright law) on the CBMS123/234 iLearn page. One copy of each may then be downloaded by each student for private use. It may also be useful on occasions to consult a general chemistry textbook (e.g., Silberberg, Smith, or Aylward & Findlay) that some students already know of. The Library has many possibilities at call number QD33. The University Library also has a good collection of chemistry-related videos available for viewing. There are many useful resources on the Web. Access to some that are highly recommended can be gained *via* the “Lots of Links” section on the CBMS123/234 iLearn page *or* by keying in known URLs *or* by using your



favourite search engine.

## Unit web page

The web page for these units can be found at: <http://ilearn.mq.edu.au/> You are expected to access the web pages regularly, where you may find announcements, links to interesting internet facilities and sites of interest to the course, downloadable software, and lots of other interesting stuff. In addition all the lectures and printed notes for the lectures will be found only on the unit web page and it is up to you to keep up with the lectures and assessments.

## Technology Used

You are expected to have access to the internet and access the unit iLearn site on a regular basis. Please note information may also be sent by e-mail to your student e-mail account so please look at your e-mail account on a regular basis. All lectures are on-line and are accessible via the Echo360 EchCenter page in iLearn. If you are unfamiliar with the Ech360 EchoCenter the refer to the "Student Guide to Echo360 Lecture Recordings" available from: [http://www.mq.edu.au/iLearn/student\\_info/lecture\\_recordings.htm](http://www.mq.edu.au/iLearn/student_info/lecture_recordings.htm)

All unit notes are presented as PDF files that require acrobat reader: <http://get.acrobat.com/uk/reader/>

General use computers are provided by the University, but it would be advantageous to have your own computer and internet access. If you have problems with the streaming video/audio lectures, you can download the entire lecture series as an ISO file and burn your own CD/DVD.

## Unit Schedule

Four e-lectures are nominally scheduled each week but you can go to the lectures any time you want and as many times as you like. Each e-lecture has Web-based material, comprising downloadable lecture notes (for printing) and an audiovisual presentation (for viewing, with active links) and a lot-of-links page for internet reseources. **CBMS123/234 has no final examination.** Therefore the timetable for preparing and submitting assignments must be strictly observed. The Department reserves the right to vary details of this schedule if necessary, with an undertaking that adequate notice of any such variations will be given to enrolled students. It is each student's responsibility to keep in regular touch with the Web-based information.

### Session 3 EOY Schedule for

#### CBMS123/234 Alchemy, Drugs and the Quest for Immortality

**Lecturers:** PK = Prof. Peter Karuso; JJ = Dr Joanne Jamie\*; MN = Ms Maree Nelson; BO = Prof. Brian Orr\*

Week # commencing	e-lecture	e-lecture	Assignment / activities scheduled this week
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1 ...8 Dec	L0: Introduction – Introductory Remarks and navigating this unit	L1:Chemistry through the Ages BO L2:Elements of Chemistry BO	<i>Familiarisation with unit notes, Library services, e-resources,...; Prepare for Workshop W1</i>
	L3:Aluminium from Ore to BOOven <i>plus</i> Preview of L4,  L5 & E1	L4:Bridges for Civilisation BO ... <b>W1 is due at 9 am Dec 12</b>	<b>W1 Quiz on L1-5</b> <i>Prepare for Workshop W1 and Essay E1</i>
2 ...15 Dec	L5:Chemistry – Creative, BO Useful and Central	L6:Health, Life & Natural PK Products – Shipworm to  Carbolic Acid	<i>Prepare for Essay E1</i>  <b>W2Quiz on L6-10</b> <i>Prepare for Workshop 3</i>
	L7:Health, Life & Natural Products PK – Salvarsan to Penicillin;	L8: Health, Life & Natural PK Products - What Do  Molecules Look Like? ... <b>W2 is due at 9 am Dec 19</b>	<b>E1 Pick either a Book Chapter or a Chemical Industry</b>  ... <b>E1 is due at 9 am Dec. 24</b>
<b>RECESS (25 Dec – 29 Dec) Prepare Essay E2 and Workshop 3</b>			
3 ...29 Dec	L9: Health, Life & Natural  JJ Products - Chemicals  from Nature	L10: Biochemical Catalysts PK – Enzymes at Work	<i>Prepare for Workshop W3</i>
	L11: Industrial Catalysts – BO The Legacy of Fritz  Haber	L12: Molecules Everywhere BO Space, Primordial Slime ...	<b>W3 Quiz on L10-14</b> <i>Prepare for Essay E2</i> ... <b>W3 is due at 9 am Jan 2</b>
4 ...5 Jan	L13: Is Chemistry Art or PK Science?	L14: New Materials – JJ Modern Alchemy	<i>Prepare for Workshop 4</i>
	L15: Chemistry in and for the MN Environment #1	L16: Chemistry in and for the MN Environment #2	<b>W4Quiz on L15-16</b> ... <b>W4 is due at 9 am Jan 9</b>
5 ...12 Jan	L17: Chemical Identity PK – What are you?	L18 Chemical Identity – JJ How much of you is there?	<b>E2 Write a Poem! On Chemistry or chemical philosophy or an essay of the Philosophy of Chemistry (L17-21)</b>

	<b>L19:</b> Chemical Identity PK – What is going on?	<b>L20:</b> Chemical identity PK – The same ... but different	<b>... E2 is due at 9 am Jan 16</b> <i>Prepare for Workshop W5</i>
<b>6</b> ... 19 Jan	<b>L21:</b> When Things Go Wrong ... PK	<b>L22:</b> A Famous Chemist – BO Linus Pauling	<b>W5 Quiz on L13, 17-22</b>
	<b>L23:</b> Stop Press – The 2013 Nobel Prize in Chemistry PK	<b>L24:</b> 2005-2012 Nobel Prizes in Chemistry (see under L23)	<b>... W5 is due at 9 am Jan 23</b>

\* Please note, the e-lectures given by Prof. Brian Orr are administered by Dr Chris McRae.  
Note: CBMS reserves the right to vary details of this schedule if necessary

## 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](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](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](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/](https://students.mq.edu.au/support/student_conduct/)

Academic Senate has a set of guidelines on the distribution of grades across the range from fail to high distinction based on **the level of understanding and comprehension achieved** (see above).

Your raw aggregate mark for the unit (i.e., the total of marks from all assessment items) **is not the same as the SNG**. Results will be scaled to ensure that there is a degree of consistency between the final SNG and student attainment. University policy does not require that a minimum number of students are to be failed or passed in any unit. The process of scaling will never change the ranking order among students. As a **very** rough guide, in this unit, you will need to achieve about 55 raw marks for a Pass, 69 for a Credit, 79 for a Distinction and 84 for a High Distinction. These numbers vary only slightly from year to year and will be converted to an SNG by application of a normalised distribution. Irrespective of your raw aggregate mark you must submit satisfactory efforts for **ALL** assessment tasks to pass this unit

## 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://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:

#### Assessment tasks

- W1
- E1

### 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 outcome

- Integrate your previous experiences and knowledge into a chemical framework

### 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:

#### Assessment task

- W2

### 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**

- To appreciate the role of chemistry in the history of the universe, world and society
- Integrate your previous experiences and knowledge into a chemical framework
- Appreciate the role of the chemist in human history and modern society, now and into the future

## **Assessment tasks**

- W1
- W2
- W3

## **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 outcome**

- To appreciate the role of chemistry in the history of the universe, world and society

## **Assessment tasks**

- W1
- W2
- W3
- W4

## **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

- To appreciate the role of chemistry in the history of the universe, world and society
- Appreciate the role of the chemist in human history and modern society, now and into the future

## Assessment tasks

- W3
- W4
- E2

## 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

- To appreciate the role of chemistry in the history of the universe, world and society
- Appreciate the role of the chemist in human history and modern society, now and into the future

## Assessment task

- E2

## 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

- To appreciate the role of chemistry in the history of the universe, world and society
- Integrate your previous experiences and knowledge into a chemical framework
- Appreciate the role of the chemist in human history and modern society, now and into the future

the future

## **Assessment tasks**

- W5
- E1

## **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**

- Integrate your previous experiences and knowledge into a chemical framework
- Appreciate the role of the chemist in human history and modern society, now and into the future

## **Assessment tasks**

- W5
- E1