ANU EXTENSION

CHEMISTRY - ANU

H COURSE

BSSS
AUSTRALIAN CAPITAL TERRITORY

Course Adoption Form for Accredited Courses

College: Australian National University Extension				
Course Title: Chemistry ANU		**Classification: H**		
Framework:		**Course Area:**	**Course Code:**	
Dates of Course Accreditation:		**From** **2016**	**to**	**2020**

Identify units to be adopted by ticking the check boxes

Adopt	Unit Title	Value (1.0/0.5)	Length
☐	**Structure, Bonding and Organic Chemistry**	**1.0**	**3Q**
☐	Structure and Bonding	0.5	1.5Q
☐	Advanced Organic Chemistry	0.5	1.5Q
☐	**Kinetics Spectroscopy & Electrochemistry**	**1.0**	**3Q**
☐	Advanced Kinetics	0.5	1.5Q
☐	Electrochemistry &Spectroscopy	0.5	1.5Q

H Classification: The course and units named above are consistent with H course policy and are signed on behalf of the BSSS.

Principal: / /20	Panel Chair: / /20

BSSS Office Use
Entered into database: / /20

Contents

Course Name

Chemistry ANU

Course Classification

H

Course Developers

Name	Qualifications
Dr Kathryn White	BSc (Hons) (USyd), PhD (USyd), Grad.Dip.Ed (CSU)
Dr Mary Adams	BSc (Hons)) (USyd), PhD (USyd), Grad.Dip.Ed (UC)
Cate Rosier	BSc (Hons) University of Adelaide Grad. Dip. Ed (CCAE)

The work of the developers of the previous Chemistry H course (Dr Mark Ellison (ANU) Cate Rosier, Dr Mary Adams, A/Prof. Geoff Salem (ANU), Sarah Sukumar and Bill Zimmerman) is also acknowledged.

Course Length and Composition

The definition of a unit and hour requirements for a standard unit and course duration, as outlined in policies 3.2.7 Unit, 3.2.7.1 Unit Values and 3.2.6.3 Course Duration (2014 BSSS Policy and Procedures Manual), apply to H courses.

Unit Title	Unit Value
Structure, Bonding and Organic Chemistry	**1.0**
Structure and Bonding	0.5
Advanced Organic Chemistry	0.5
Kinetics Spectroscopy & Electrochemistry	**1.0**
Advanced Kinetics	0.5
Electrochemistry and Spectroscopy	0.5

Available Course Patterns

Course	Minimum number of hours per course	Number of standard 1.0 value units to meet course requirements
Minor	110 hours	2 units of 55 hours

Implementation Guidelines

Arrangements for continuing students

Students completing the Structure, Bonding and Kinetics unit (20219) in 2015 in the previous Chemistry H course (2024) may combine that unit with the Kinetics Spectroscopy & Electrochemistry unit from this course in 2016 to form a minor.

Prerequisites or co requisites home college course/s

Students must be enrolled in Chemistry (major) at their home school/college concurrently with this course.

Contribution towards an ATAR

Students can count up to 2 H courses to a maximum weight of 1.2 (equivalent to 2 minors) out of the required 3.6 in the calculation of the ATAR.

A maximum of 4 standard units from H courses can contribute to the minimum requirements for a Year 12 Certificate and Tertiary Entrance Statement.

Reporting of H courses on the ACT Senior secondary Certificate

Home college and H courses are reported separately, each with its own course type.

A 'T' classified major minor and 'H' minor in the same subject are equivalent to a double major course type.

If the student has completed insufficient H units to form a course, the units may be included in the home college course in the same course area but do not contribute to the course score. *(Refer section 9 University Programs in 2015 Policies and Procedures Manual)*

Goals

This course is intended for students in Year 11 and 12 who have an interest and aptitude in Chemistry or who require the skills and/or background covered in this course for further study at tertiary level.

Goals are statements of intended student outcomes. This course should enable students to develop an:

- appreciation of the contribution Science has made to a contemporary society
- appreciation of how scientific knowledge can be used to address contemporary issues
- understanding that scientific knowledge has developed over time, is used in a variety of contexts; and influences, and is influenced by, social, economic, cultural and ethical considerations
- understanding of the theories and models used to describe, explain and make predictions about systems, structures and properties
- understanding that Science is experimental and has developed through independent and collaborative research, and has significant impacts on society and implications for decision making
- ability to communicate scientific understandings, findings, arguments and conclusions using appropriate resources, modes and genres
- ability to conduct a variety of field, research and laboratory investigations involving collection and critical analysis of qualitative and quantitative data, and interpretation of evidence
- ability to critically evaluate and debate scientific arguments and claims in order to solve problems and generate informed, considered and ethical conclusions.

Student Group

Students apply to ANU for entry to this course and suitable applicants are selected at the beginning of their Year 11 year through a selection process. This process may include some or all of; a selection test, evidence provided of past academic successes, school/college recommendation.

Students must be enrolled in Chemistry (major) at an ACT school/college.

A student who reaches a satisfactory standard in this course that reflects an ability to succeed at university level will be made an early offer of entry to the ANU. The offer will be for the BSc or BSc (Advanced) Hons or PhB course depending on the level of achievement. A pass in this course is not a guarantee of an early offer. Early offers are decided by the Dean of Sciences. The students will also be awarded a six point credit towards an ANU undergraduate course.

Assessment

There will be 4 – 6 summative assessment items for a 1.0 point unit and 2 – 3 for a 0.5 point unit.

Task Types	**Student Investigations**	**Tests**
The following examples are a guide only	Logbook Practical Report Scientific Poster Research Assignment Seminar / Oral / Electronic presentations Project Essay Models	Unit tests Practical skills test Quizzes
Weighting	40 – 60 %	40 – 60 %

Moderation

9.2.2 Moderation of H courses (2015 BSSS Policies and Procedures Manual)

Teachers of H courses will be required to present portfolios of student work for verification that units are taught and assessed as documented. The Moderation Officer will report any concerns to the Board.

A Year 11 review portfolio will be prepared in December, after the end of the first 1.0 point unit, for Moderation Day 1 the following year.

A Year 12 review portfolio will be prepared by Week 3, Term 4 following the completion of the Year 12 unit at the end of Term 3.

Review portfolios will present the work of two students at different grade levels. Grades in H courses are not subject to moderation.

Bibliography

Recommended Texts

The recommended text will be one of the following:

- Burrows et al, (2009) *Chemistry Cubed*, 1st ed, Oxford.
- Brown, T.L. et al, (2013) *Chemistry: The Central Science*, 3rd ed, Pearson Australia.

This was correct at the time of publication.

Structure, Bonding and Organic Chemistry Value 1.0

Prerequisites

Enrolled in the first unit of Chemistry at their home college.

Specific Unit Goals

This unit should enable students to:

- Demonstrate an understanding of detailed electronic structure
- Demonstrate a knowledge of and predict molecular shapes based on the VSEPR model
- Predict dipole moments based on bond polarities and molecular shape
- Demonstrate a knowledge of and compare the limitations of valence bond and MO theories
- Identify hybrid orbitals involved in bonding through construction of models
- Demonstrate a knowledge of the various functional groups in organic chemistry and how they interrelate
- Classify organic molecules in terms of their spatial arrangement
- Describe reaction mechanisms for organic chemistry reactions
- Synthesise organic products from a range of starting materials

Content

- Electronic structure involving a detailed investigation of s, p, d and f atomic orbitals.
- Valence Shell Electron Pair Repulsion theory (VSEPR); coordination numbers 2-6
- Bond polarity and molecular dipole moments
- Valence Bond theory and orbital hybridisation
- Molecular Orbital (MO) theory
- Advanced organic chemistry including a detailed study of functional groups and their reactivity
- Isomerism and stereochemistry
- Mechanisms (E1 and E2, SN1 and SN2, Electrophilic Addition) for selected organic reactions including the use of arrows to indicate electron movement

Teaching and Learning Strategies

For this introductory unit of work, care will be taken to develop the student's chemical literacy to a satisfactory level.

A range of strategies will be used some of which are:

- The use of molecular modelling to facilitate the understanding of the shapes of molecular structures
- Students will be introduced to the concept of 3-D computer modelling to illustrate molecular orbitals
- Students will use Web-based applets to describe organic chemistry mechanisms
- The use of molecular modelling to facilitate the understanding of the shapes of molecular structures
- The use of small group activities including peer mentoring to develop problem solving skills for understanding reaction mechanisms of organic reactions

- Students will perform a number of experiments to investigate properties and reactivities of organic functional groups

Assessment

There will be 4 – 6 summative assessment items for a 1.0 point unit and 2 – 3 for a 0.5 point unit.

Task Types	**Student Investigations**	**Tests**
The following examples are a guide only	Logbook Practical Report Scientific Poster Research Assignment Seminar/Oral/Electronic presentations Project Essay Models	Unit tests Practical skills test Quizzes
Weighting	40 – 60 %	40 – 60 %

Specific Unit Resource

Recommended Texts

The recommended text will be one of the following:

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- Brown, T.L. et al, (2013) *Chemistry: The Central Science*, 3rd ed, Pearson Australia.

This was correct at the time of publication.

Structure and Bonding Value 0.5

Prerequisites

Enrolled in the first unit of Chemistry at their home college.

Specific Unit Goals

This unit should enable students to:

- Demonstrate an understanding of detailed electronic structure
- Demonstrate a knowledge of and predict molecular shapes based on the VSEPR model
- Predict dipole moments based on bond polarities and molecular shape
- Demonstrate a knowledge of and compare the limitations of valence bond and MO theories
- Identify hybrid orbitals involved in bonding through construction of models

Content

- Electronic structure involving a detailed investigation of s, p, d and f atomic orbitals.
- Valence Shell Electron Pair Repulsion theory (VSEPR); coordination numbers 2-6
- Bond polarity and molecular dipole moments
- Valence Bond theory and orbital hybridisation
- Molecular Orbital (MO) theory

Teaching and Learning Strategies

For this introductory unit of work, care will be taken to develop the student's chemical literacy to a satisfactory level.

A range of strategies will be used some of which are:

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There will be 4 – 6 summative assessment items for a 1.0 point unit and 2 – 3 for a 0.5 point unit.

Task Types	**Student Investigations**	**Tests**
The following examples are a guide only	Logbook Practical Report Scientific Poster Research Assignment Seminar/Oral/Electronic presentations Project Essay Models	Unit tests Practical skills test Quizzes
Weighting (most units)	40 – 60 %	40 – 60 %

Specific Unit Resource

Recommended Texts

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This was correct at the time of publication.

Advanced Organic Chemistry Value 0.5

Prerequisites

Structure and Bonding

Specific Unit Goals

This unit should enable students to:

- Demonstrate a knowledge of the various functional groups in organic chemistry and how they interrelate
- Classify organic molecules in terms of their spatial arrangement
- Describe reaction mechanisms for organic chemistry reactions
- Synthesise organic products from a range of starting materials

Content

- Advanced organic chemistry including a detailed study of functional groups and their reactivity
- Isomerism and stereochemistry
- Mechanisms (E1 and E2, SN1 and SN2, Electrophilic Addition) for selected organic reactions including the use of arrows to indicate electron movement

Teaching and Learning Strategies

A range of strategies will be used some of which are:

- Students will use Web-based applets to describe organic chemistry mechanisms
- The use of molecular modelling to facilitate the understanding of the shapes of molecular structures
- The use of small group activities including peer mentoring to develop problem solving skills for understanding reaction mechanisms of organic reactions
- Students will perform a number of experiments to investigate properties and reactivities of organic functional groups

Assessment

There will be 4 – 6 summative assessment items for a 1.0 point unit and 2 – 3 for a 0.5 point unit.

Task Types	**Student Investigations**	**Tests**
The following examples are a guide only	Logbook Practical Report Scientific Poster Research Assignment Seminar/Oral/Electronic presentations Project Essay Models	Unit tests Practical skills test Quizzes
Weighting	40 – 60 %	40 – 60 %

Specific Unit Resource

Recommended Texts

The recommended text will be one of the following:

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This was correct at the time of publication.

Kinetics Spectroscopy & Electrochemistry Value 1.0

Prerequisites

Structure and Bonding, Advanced Organic Chemistry

Specific Unit Goals

This unit should enable students to:

- Demonstrate problem-solving skills related to reaction kinetics
- Appreciate that chemical reactions can proceed via different mechanisms
- Analyse spectroscopic information to investigate reaction kinetics
- Identify various instrumental methods for elucidating structural information of organic compounds
- Extrapolate an organic structure from spectral information
- Investigate the relationships between thermochemistry, electrochemistry and equilibrium
- Demonstrate problem-solving skills related to thermochemical processes
- Present clear and well-reasoned scientific reports

Content

- Reaction kinetics, including graphical analysis
- Molecularity
- Enzyme (Michaelis-Menten) and polymer kinetics
- Advanced thermochemistry and electrochemistry, including enthalpy, entropy and Gibb's free energy, the Nernst equation, and the relationship between ΔG, equilibrium and cell potential.
- Advanced instrumental methods including NMR, MS, UV-vis and IR.

Teaching and Learning Strategies

A range of strategies will be used some of which are:

- The use of small group activities including peer mentoring to develop problem-solving skills for thermochemical reactions
- Students will use Web-based applets to describe kinetic mechanistic steps
- Students will perform a number of experiments to investigate kinetic relationships
- Students will analyse organic material using a range of analytical instruments
- Students will access spectral data bases (eg SDBS, and Spectra School) to develop their skills in identifying organic materials
- Students will plan and carry out experiments involving electrochemical reactions.

Assessment

There will be 4 – 6 summative assessment items for a 1.0 point unit and 2 – 3 for a 0.5 point unit.

Task Types	Student Investigations	Tests
The following examples are a guide only	Logbook Practical Report Scientific Poster Research Assignment Seminar/Oral/Electronic presentations Project Essay Models	Unit tests Practical skills test Quizzes
Weighting	40 – 60 %	40 – 60 %

Specific Unit Resource

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This was correct at the time of publication.

Advanced Kinetics Value 0.5

Prerequisites

Structure and Bonding, Advanced Organic Chemistry

Specific Unit Goals

This unit should enable students to:

- Demonstrate problem-solving skills related to reaction kinetics
- Appreciate that chemical reactions can proceed via different mechanisms
- Analyse spectroscopic information to investigate reaction kinetics
- Present clear and well-reasoned scientific reports

Content

- Reaction kinetics, including graphical analysis
- Molecularity
- Enzyme (Michaelis-Menten) and polymer kinetics
- Advanced instrumental methods including UV-Vis (and optionally IR).

Teaching and Learning Strategies

For this introductory unit of work, care will be taken to develop the student's chemical literacy to a satisfactory level.

- The use of small group activities including peer mentoring to develop problem solving skills for thermochemical reactions
- Students will use Web-based applets to describe kinetic mechanistic steps
- Students will perform a number of experiments to investigate kinetic relationships

Assessment

There will be 4 – 6 summative assessment items for a 1.0 point unit and 2 – 3 for a 0.5 point unit.

Task Types	**Student Investigations**	**Tests**
The following examples are a guide only	Logbook Practical Report Scientific Poster Research Assignment Seminar/Oral/Electronic presentations Project Essay Models	Unit tests Practical skills test Quizzes
Weighting (most units)	40 – 60 %	40 – 60 %

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This was correct at the time of publication.

Electrochemistry & Spectroscopy Value 0.5

Prerequisites

Structure and Bonding, Advanced Organic Chemistry, and Advanced Kinetics

Specific Unit Goals

This unit should enable students to:

- Identify various instrumental methods for elucidating structural information of organic compounds
- Extrapolate an organic structure from spectral information
- Investigate the relationships between thermochemistry, electrochemistry and equilibrium
- Demonstrate problem-solving skills related to thermochemical processes
- Present clear and well-reasoned scientific reports

Content

- Advanced thermochemistry and electrochemistry, including enthalpy, entropy and Gibb's free energy, the Nernst equation, and the relationship between ΔG, equilibrium and cell potential.
- Advanced instrumental methods including NMR, MS, UV-Vis and IR.

Teaching and Learning Strategies

A range of strategies will be used some of which are:

- Students will analyse organic material using a range of analytical instruments
- Students will access spectral data bases (eg. SDBS) to develop their skills in identifying organic materials
- Students will plan and carry out experiments involving electrochemical reactions.

Assessment

There will be 4 – 6 summative assessment items for a 1.0 point unit and 2 – 3 for a 0.5 point unit.

Task Types	**Student Investigations**	**Tests**
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