Physical and Analytical Chemistry 2106NSC - Tri 2 2021 - Nathan Campus - Blended

1. General Course Information

1.1 Course Details

Course code	2106NSC
Course title	Physical and Analytical Chemistry
Academic organisation	ESC School of Environment and Science
Trimester	Trimester 2 2021
Mode	Blended
Level	Undergraduate
Location	Nathan, On Campus
Credit point value	10

Course Description:

This course provides the essential information for the understanding of chemical processes, structure and change. It builds upon the understanding of chemical principles introduced in the first year, and prepares students for third year courses. It establishes and develops chemical principles in terms of the underlying concepts of physics and, frequently, the language of mathematics. The course covers the fundamental principles of thermodynamics, phase and chemical equilibria, properties of solutions and phase equilibria, as well as kinetics and mechanisms of chemical reactions. The associated laboratory component reinforces the understanding of these principles and illustrates the use of selected analytical techniques applied to experimental thermodynamics and kinetics. Pre-requisites: 1021SCG Chemistry 1A and 1022SCG Chemistry 1B, or equivalent; 1011SCG Mathematics IA or 1201SCG Linear Algebra or 1013SCG Applied Mathematics. Incompatible: 2120SCE Reaction Kinetics, 2124SCE Thermodynamics, 2104BPS Physical Chemistry, 2106BPS Physical & Analytical Chemistry

Assumed Background:

A good understanding of first year mathematics.

Incompatible: 2120SCE Reaction Kinetics, 2124SCE Thermodynamics, 2104BPS Physical Chemistry, 2106BPS / 2202ENV Physical & Analytical Chemistry

1.2 Course Introduction

This course continues the physical chemistry theory developed in thermodynamics and kinetics which commenced in first year chemistry. Students use their mathematical and chemical knowledge to explore the physical chemistry of real systems. The mathematics of differentiation and integration are used to solve rate equations and thermodynamic problems numerically. Laboratory exercises are employed to demonstrate the application of the physical chemistry principles discussed in lectures and developed in tutorials.

Previous Student Feedback

Student feedback has commented favourably on the applicability of the weekly assignments and experimental work to the lectures. As fundamental mathematical procedures are an integral part of physical chemistry, students with a low literacy of high school level mathematics found some aspects of the course challenging. The weekly assignments were recognised as a helpful aid for revision and assisted the students to understand the processes associated with solving numerical kinetics and thermodynamics problems. Following student experience on course timetabling in the previous offering, the lectures are now on separate day from tutorial class.

1.3 Course Staff

Primary Convenor **A/Prof Yulin Zhong**

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1.4 Timetable

Timetables are available on *the Programs and Courses website*.

NB: Details contained in this Section of the course profile and Section 4.1 Learning Activities are to be read in conjunction with the official class timetable. The published class timetable which is the authoritative source for timetabling information for all campuses can be located by clicking on the above link.

Additional Timetable Information

The course will be presented through a combination of lectures (30 hours), tutorials (12 hours) and laboratory assignments (32 hours comprising 16 hours in the laboratory and 16 hours for preparation, analysis of data and write-up). There will be an average of 2-hours lectures and a 1-hour tutorial each week. Fundamental physical chemistry theory and its applications will be presented in the lectures. Problem solving skills will be developed in the weekly assignments, tutorials and laboratory experiments.
There will be 10 weekly assignments. This will require numerical problem solving as well as revision of the fundamental principles. Each assignment will take approximately 1 hour to complete.
Four laboratory assignments (Weeks 7-10) are to be completed by each student. These will each involve 4 hours of laboratory work and ~4 hours of preparation/data analysis/write-up; classes are allocated by the laboratory staff based on timetable requirements and equipment availability. The students will carry out laboratory work in teams (pairs or teams of three), but will produce individual reports which are checked for plagiarism. It is highly recommended to attend to data analysis and reports after each laboratory assignment.
The laboratory classes are compulsory and students must achieve a passing grade for these skills. An attendance record is kept for the laboratory component. Attendance at lectures and tutorials is highly recommended.

This course can only be completed with at least some on campus activities taking place in Trimester 2, 2021. If Government regulations allow, we will schedule these components when access to campus resumes. If you are unable to attend campus at any time during Trimester 2, 2021 and need to take this course in Trimester 2, 2021 (e.g. for graduating), please contact your Program Director. Ensure you check the Learning@Griffith course site for specific details of classes.

1.5 Lecture Capture

It is standard practice at Griffith University that lectures timetabled in lecture capture-enabled venues are recorded and made available to students on the relevant course site, in accordance with the University's Lecture Capture Policy.

The lecture series delivered as part of this course will be recorded and accessible via the Learning@Griffith course site.

1.6 Technical Specifications

Online studies are optional; there are no special IT requirements.

2. Aims, Outcomes & Graduate Attributes

2.1 Course Aims

The course is a central part of the Chemistry Major. It provides the fundamental second year level study of physico-chemical properties, processes and principles of chemical reactions. The course is an advance on the components of physical chemistry in the first year Chemistry courses and leads on to third year subjects. It is essential background for all students studying equilibrium chemical processes, solutions, and reactions, e.g. in courses on inorganic, forensic, organic, physical and biological chemistry. The course aims to provide students with a solid understanding of the laws of thermodynamics, phase and chemical equilibria properties of solutions, electrochemistry and phase separation, as well as rate equations, determination of orders and rate constants, temperature-dependence of reaction kinetics, reactions in solution and catalysis. It assumes a good understanding of first year mathematics.

2.2 Learning Outcomes

After successfully completing this course you should be able to:

1 Appreciate the fundamental theories and principles of reaction thermodynamics and kinetics, the importance of these fields to science, and their applications to solve a range of problems.

2 Determine directions of reactions based on free energies and activities.

3 Understand phase and chemical equilibria, draw and interpret phase diagrams.

4 Understand colligative properties and solve problems related to these.

5 Understand the differences between electrolytes, weak electrolytes and non-electrolytes, electrode potentials and treat problems related to these.

6 Read and write rate equations, know the techniques for following reactant and/or product concentrations during the course of a reaction.

7 Be able to determine orders of reactions and rate constants from experimental data.

8 Be able to predict the temperature dependence of reaction rate constant and understand the Arrhenius equation.

2.3. Graduate Attributes

For further details on the Griffith Graduate please click here

Griffith University prepares influential graduates to be:

- Knowledgeable and skilled, with critical judgement
- Effective communicators and collaborators
- Innovative, creative and entrepreneurial
- Socially responsible and engaged in their communities
- Culturally capable when working with First Australians
- Effective in culturally diverse and international environments

This table demonstrates where each of the Griffith Graduate Attributes is taught, practised and assessed in this course.

For further details on the Griffith Graduate Attributes please refer to The Griffith Graduate policy.

University wide attributes

Graduate Attribute	Taught	Practised	Assessed
Knowledgeable and skilled, with critical judgement	•	•	•
Effective communicators and collaborators	•	•	
Innovative, creative and entrepreneurial	•	•	•
Socially responsible and engaged in their communities		•	
Culturally capable when working with First Australians		•	
Effective in culturally diverse and international environments		•	

Additional Course Information on Graduate Attributes

The course will provide the students with laboratory experience, as well as problem solving, data analysis and presentation skills.

On completion of the course, the students are expected to have enhanced their laboratory skills, problem solving skills, and skills at reporting and analysing information.

3. Learning Resources

3.1 Required Resources

Details of your Required Learning Resources are available from the Reading List.

3.2 Recommended Resources

Details of your Recommended Learning Resources are available from the Reading List.

3.3 University Learning Resources

The University provides many facilities and support services to assist students in their studies. Links to information about University support resources that are available to students are included below for easy reference.

Readings - New online service enabling students to access Required and Recommended Learning resources. It connects to the library catalogue to assist with quickly locating material held in Griffith libraries and enables students to manage and prioritise their readings, add personal study notes and export citations.

Learning@Griffith - there is a dedicated website for this course via the Learning@Griffith at myGriffith.

Academic Integrity Tutorial - this tutorial helps students to understand what academic integrity is and why it matters. You will be able to identify types of academic misconduct, understand what skills you will need in order to maintain academic integrity, and learn about the processes of referencing styles.

Student Support - provides a range of services to support students throughout their studies including personal support such as Counselling and Health Services; Academic support; and Financial and Welfare support.

The Careers and Employment Team provides: Career Wellbeing, Career Planning and Decision Making, Finding Jobs, Skills Identification and Development, Graduate Employment Information, LinkedIn Profile Review, Interview Preparation, Online Psychometric and Aptitude Test Preparation, International Student Support, Disability Disclosure Strategies and Higher Degree Research (HDR) Career Consultations.

Library and Learning Services: Library and Learning Services provides a wide range of quality client-focused services and programs to students, researchers and staff of the University. Library and Learning Services works in collaboration with the academic community to achieve academic and research outcomes.

Support for learning - the University provides access to common use computing facilities for educational purposes.

Code of Practice - Griffith Information Technology Resources.

3.5 Other Learning Resources & Information

Lecture and tutorial notes are available on the course web site and their use in revision of course content is highly recommended.

4. Teaching & Learning Activities

4.1 Learning Activities

Week Commencing	Activity	Learning Outcomes
19 Jul 21	**Introduction, Thermodynamics 1-2 (Lecture):**	1, 2
19 Jul 21	**Applications of physical chemistry (Tutorial):** Maths revision (self study)	1
26 Jul 21	**Thermodynamics 3-4 (Lecture):**	1
26 Jul 21	**Applications of physical chemistry (Tutorial):** Assignment 1	1

Week Commencing	Activity	Learning Outcomes
2 Aug 21	**Thermodynamics 5-6 (Lecture):**	1, 3
2 Aug 21	**Applications of physical chemistry (Tutorial):** Assignment 2	1
16 Aug 21	**Thermodynamics 7-8 (Lecture):**	1, 3, 4
16 Aug 21	**Applications of physical chemistry (Tutorial):** Assignment 3	1
23 Aug 21	**Thermodynamics 9-10 (Lecture):**	1, 3, 4, 5
23 Aug 21	**Applications of physical chemistry (Tutorial):** Assignment 4	1
30 Aug 21	**Thermodynamics 11-12 (Lecture):**	1, 2, 3, 4, 5
30 Aug 21	**Applications of physical chemistry (Tutorial):** Assignment 5	1
6 Sep 21	**Kinetics 1-2 (Lecture):**	1, 6
6 Sep 21	**Lab (Laboratory):** Lab activity comprises one of four experiments.	1, 2, 3, 4, 5, 6, 7, 8
6 Sep 21	**Applications of physical chemistry (Tutorial):** Assignment 6	1
13 Sep 21	**Kinetics 3-4 (Lecture):**	1, 6, 7
13 Sep 21	**Lab (Laboratory):** Lab activity comprises one of four experiments.	1, 2, 3, 4, 5, 6, 7, 8
13 Sep 21	**Applications of physical chemistry (Tutorial):** Assignment 7	1
20 Sep 21	**Kinetics 5-6 (Lecture):**	1, 6, 7, 8
20 Sep 21	**Lab (Laboratory):** Lab activity comprises one of four experiments.	1, 2, 3, 4, 5, 6, 7, 8
20 Sep 21	**Applications of physical chemistry (Tutorial):** Assignment 8	1
27 Sep 21	**Lab (Laboratory):** Lab activity comprises one of four experiments.	1, 2, 3, 4, 5, 6, 7, 8
27 Sep 21	**Kinetics 7-8 (Lecture):**	1, 6, 7, 8
27 Sep 21	**Applications of physical chemistry (Tutorial):** Assignment 9	1
4 Oct 21	**Kinetics 9-10 (Lecture):**	1, 6, 7, 8
11 Oct 21	**Revision lecture (Lecture):**	1, 2, 3, 4, 5, 6, 7, 8
11 Oct 21	**Applications of physical chemistry (Tutorial):** Assignment 10	1

4.2 Other Teaching and Learning Activities Information

The course is divided into two main themes of fundamental Physical Chemistry: Thermodynamics and Kinetics.

Theme 1: Thermodynamics

Revision of some basic concepts in Fundamental Thermodynamics; Entropy; Free Energy; Properties of real systems; Liquids, Phases; Phase diagrams; Thermodynamic aspects of phase transitions; Mixtures of volatile liquids; Phase diagrams of multi-component systems; Fundamentals of electrochemistry; Solutions of electrolytes; Transport properties; Molecular motion in liquids.

Theme 2: Kinetics

Reaction rates, Rate constants, Reaction order; Reaction profile, Differential and integrated rate expressions; Determination of the rate law, Equilibrium, Temperature dependence; Linking the rate law and reaction mechanism; The Lindemann-Hinshelwood mechanism, Polymerisation kinetics; Collision theory; Diffusion and activation control, Transition state theory; Homogeneous catalysis; Heterogeneous catalysis.

If a lecture or tutorial class is scheduled on a public holiday (or is cancelled for any unexpected reason), this class will normally not be repeated.

Disability. If any student has a disability and/or health condition that may impact on their ability to successfully undertake required learning activities in this course, they are encouraged to complete the Griffith University Disclosure Statement and advise their Course Convenor.