

## Introduction

Welcome to Chemistry 123S (CHEM123S).

CHEM123S is an introductory level course for everyone who has no chemistry background or only a weak background in chemistry. CHEM123S is also a foundation level unit for students entering science based degree programs. It is intended as an introduction to chemistry and a bridging course, specifically designed to provide the necessary assumed knowledge for entry into university chemistry units such as Chemistry 110 (CHEM110), which is offered at UNE.

The overall aim of CHEM123S is to provide “tools” of chemistry and a good level of confidence in chemistry by which students will be brought to a level, where they can enjoy doing first year tertiary level chemistry such as UNE’s CHEM110 and CHEM120.

Examination and a two-day residential school, in which practical training will be given, are optional for this CHEM123S, but with the residential school and the examination, this CHEM123S will be identical to CHEM123, which is offered to UNE students during semester period.

A certificate will be issued on completion of CHEM123S.

## Content of chem123S

CHEM123S is to study the whole content of the textbook (see below) with a personal tutor (the coordinator of CHEM123S). There are six sets of assignments. A Study Guide/Workbook will be supplied to assist your work on the textbook but it is not required to submit Study Guide/Workbook, which is designed merely to assist your studying the textbook.

It is suggested that you study one or two Chapters of the textbook every week, and attempt one assignment question everyday. Please see suggested study schedule.

Examination and a two-day residential school are optional.

If you wish to participate the two-day residential school, a small fee (\$50) is required to cover the cost of laboratory expenses and you need to come to Armidale for pre-determined days (please contact the coordinator of CHEM123S for the dates).

## Textbook and data book

### Textbook

Zumdahl, “*Introductory Chemistry*” 6<sup>th</sup> edition, Houghton-Mifflin,

ISBN: 9780-6188-03293 (You can also use the 5<sup>th</sup> edition of this book to do CHEM123.)

### Chemistry data book

Aylward, G.H., and Findlay, T.J.V. “*SI Chemical Data*”, 6<sup>th</sup> edition. Wiley.

Any earlier edition is good enough. This data book will also be used in UNE’s CHEM110 and CHEM120, if you enroll in them.

Order the textbook and the data book to UNE's campus bookshop:  
Phone 02-6772-3468, fax 02-6772-3469 e-mail: [armidale@ucb.net.au](mailto:armidale@ucb.net.au)

You need a **simple** “scientific calculator”, which performs logarithm and anti-logarithm calculations, to do CHEM123S (This calculator is also used in UNE's CHEM110 and CHEM120.).

Many reference books can be borrowed from Dixon Library, if you are a UNE student. Go to UNE's web page at: <http://www.une.edu.au/library/>

## Study schedule of CHEM123S

**Although you can adopt your own pace of studying CHEM123S which suits your life style**, as a model, we would suggest a pace of roughly one or two chapters of the textbook every week. Attempt one assignment question everyday. See the table on the next page.

Please use this model and modify it for your own pace in studying CHEM123S.

### Essential requirement

#### “Examples” of the textbook and assignments.

Studying all the textbook Examples and doing all the assignment questions is the core and the minimum requirement in CHEM123S. Assignment questions are at the top of each Module (of the StudyGuide/Workshop).

Read the text for one topic in a chapter of the textbook. Study the **Example(s)** there. There is one assignment question for nearly every textbook Example. Every time you are happy with one textbook Example, **immediately attempt** the corresponding assignment question.

Do not leave assignment questions to later.

The Modules in the Study Guide/Workbook are for each assignment. After finishing the textbook Examples and having done the assignment questions, you may like to further expand your coverage in the Chapters by going to “problems”, which are located at the end of each Chapter with the Study Guide/Workbook.

Please try not to memorise anything but, instead, jot down the important equations or formulas a few times on scratch paper very quickly in order to get used to them. If you began memorising everything in CHEM123S, your mind would be filled very quickly and you could not take anything any more after a few weeks.

Since you can bring your own “summary” of CHEM123S to the examination (see *Examination* below), collect items you feel you must memorise on that “summary” sheet, if you are going to sit for the exam (optional). We like you to **understand** the contents of the textbook as you read on, instead of memorising them.

Trying not to be a perfectionist, and not indulging in details, also helps you to understand the content.

Memorising items and trying to be perfectionist (or, indulgence) are two major and most common factors, which make you feel under a heavy pressure in CHEM123S, preventing **understanding** the contents of the textbook.

The topics covered by **assignment questions** show the priority in each Chapter of the textbook. Study the contents of a chapter according to the priority.

Do not indulge in any topics or chapters, but do your best for covering one or two chapters within roughly one week and, **attempt one assignment question everyday**. Try to keep in pace with your own *Study Schedule*. A model is on the next page.

## A suggested model of **Study schedule** of CHEM123S

This is a suggestion only. You should set up our own pace of studying CHEM123S.

We would suggest a pace of roughly one or two chapters of the textbook per week. Attempt one assignment question everyday.

Top priority: textbook "Examples" and assignments.

Any queries or questions, to the unit coordinator immediately.

Week	Chapters of the textbook	Assignment to be sent out
<b>Week 1.</b>	Module 1. Chapter 2 Measurement, Chapter 3 Matter Chapter 10, Energy Approx. 20 hours of study time	
<b>Week 2.</b>		
<b>Week 3.</b>	Module 2. Chapter 4 Chemical foundations, Chapter 5 Elements, Chapter 6 Reactions Approx. 20 hours of study time	Assignment 1
<b>Week 4.</b>		
<b>Week 5.</b>		
<b>Week 6.</b>	Module 3. Chapter 7 Aqueous reactions, Chapter 8. Chemical composition, <b>Residential school</b> (two days, optional) Chapter 9 Quantities Approx. 20 hours of study time	Assignment 2
<b>Week 7.</b>		
<b>Week 8.</b>		
<b>Week 9.</b>		
<b>Week 10.</b>	Module 4. Chapter 11 Atomic theory Chapter 12 Chemical bonding Approx. 20 hours of study time	Assignment 3
<b>Week 11.</b>		
<b>Week 12.</b>	Module 5. Chapter 13 Gases, Chapter 14 Liquids Chapter 15 Solutions Approx. 20 hours of study time	Assignment 4
<b>Week 13.</b>		
<b>Week 14.</b>	Module 6. Chapter 16 Acids & bases Chapter 17 Equilibrium Chapter 18 Reduction-oxidation Approx. 20 hours of study time	Assignment 5
<b>Week 15.</b>		
<b>Week 16.</b>		Assignment 6

Please contact unit coordinator for arranging the examination (optional)

### **Residential school timetable: 2 days** (optional – cost, \$50).

You need to come to Armidale on pre-determined days (usually in April or in Sept).


Please contact unit coordinator for arranging res school participation ahead of time..

Time	Day 1	Day 2
*8.45 – 9.45	*Lecture/Tute	Lecture/Tute
9.45–10.00	Break	Break
10.00 – 12.30	Practical Class Expt.1	Practical Class Expt.3
12.30 – 1.30	Lunch	Lunch
1.30– 2.30	Lecture/Tute	Lecture/Tute
2.30-2.45	Break	Break
2.45– 5.15	Practical Class Expt.2	Practical Class Expt.4

\* Day 1 begins at 9.00 am in Land Resource Lecture Theatre No.1 (LR-1) – See *Chemistry Venues* below.

## The coordinator of CHEM123S and your personal tutor

If you have any smallest query in CHEM123S, feel free to contact the unit coordinator (Kiyo Fujimori) immediately. The unit coordinator is your personal tutor for doing CHEM123S. If you have problems with understanding any of the material in the Unit, you should immediately contact the unit coordinator. Do not leave the problem too late till it grows to be a monster!

	<p><b>Dr Kiyo Fujimori, Associate Professor</b></p> <p><b>Coordinator for CHEM123S</b></p> <p>Postal address: Chemistry, University of New England, Armidale, NSW, 2351</p> <p>Phone : (02) 6773 2402 Fax: (02) 6773 3268</p> <p>e-mail: <a href="mailto:Kiyo.Fujimori@une.edu.au">Kiyo.Fujimori@une.edu.au</a></p>
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You may leave message to the administrative assistant of Chemistry.  
**Chemistry Administrative Assistant**, phone: (02) 6773 2193, e-mail: [chemistry@une.edu.au](mailto:chemistry@une.edu.au)

## Assessment

There are three components of CHEM123S, **assignments**, optional **practicals** (in residential school) and optional **examination**.  
**The six sets of assignments are compulsory.**

Assessment in CHEM123S will be carried out in proportion to the components you wish to do in CHEM123S. The proportions for components are in the below table.

If you opt for doing only assignments, you will be assessed only on the basis of assignment achievement; 6 x assignments = 100%.

If you do assignments and examination, or if you do assignments and residential school, you will be assessed on the basis of the two components;

6 x assignments + exam = 100%, or

6 x assignments + pracs = 100%.

<b>Assignments: - compulsory</b> (See <i>Study Schedule</i> for related chapters of the textbook) 6 x Assignments (8% each)	6 x 8% = <b>48%</b>
<b>Practicals</b> (residential school) – optional (\$50)	<b>12%</b>
<b>Examination</b> – optional (free)	<b>40%</b>
<b>Total</b>	<b>100%</b>

Since examination questions are directly based on the assignment questions, most people achieve very well in the examination as long as they do assignments conscientiously.

## Assignments – Compulsory

The assignment questions are attached at the top of each “Module” of Study Guide/Workbook.

We suggest you attempt one assignment question everyday.

See the table of *Study Schedule* on page 3 of this Unit Outline for suggested pace of study.

### No need to type your answers; try to save your time.

Printed copies of assignments are attached at the top of each “Module” of Study Guide/Workbook.

Please use your own sheets to write answers. No need to type your answers. Please save time by just jotting down your answers in order to save time.

### For each textbook Example, there is a corresponding assignment question

As you study one textbook “Example”, you should attempt the corresponding assignment question immediately. Attempt one assignment question everyday.

Questions in assignments are the direct source for examination questions. We expect you to put the highest priority to the concepts covered by assignment questions.

### Sending out your assignments:

Mail out your assignment work

To: Kiyu Fujimori, Chemistry, University of New England, Armidale NSW 2351,

### Each assignment weighs 8%, a total of six assignments

There are a total of six sets of assignments on six “Modules” of Study Guide/Workbook.

Assignments are compulsory, and they contribute a total of 48% to CHEM123 (ie. 8% for each assignment) if you wish to do res school and examination.

**Assignments and related chapters of the textbook.** – See also the table of *Study Schedule* on page 3 of this Unit Outline.

<i>Chapters</i>	<i>Assignment</i>
Chapters 2, 3 & 10	Assignment 1
Chapters 4,5 & 6	Assignment 2
Chapters 7, 8 & 9	Assignment 3
Chapters 11 & 12	Assignment 4
Chapters 13, 14 & 15	Assignment 5
Chapters 16, 17 & 18	Assignment 6

**No need to turn in Study Guide/Workbook, which is designed merely to facilitate your studying the textbook.**

## **Residential School** – optional, \$50.

Practical experiments will be performed in laboratory. This is an excellent opportunity to experience chemical reactions in laboratory situation.

You need to participate pre-determined residential school days (usually in April or in October). **Please contact unit coordinator ahead of time in order to arrange the res school participation.** A fee of \$50 is charged for laboratory cost, and you need to come to Armidale for two days. Accommodation at a residential college is usually available.

### **Residential school timetable: 2 days (optional).**

Time	Day 1	Day 2
*8.45 – 9.45	*Lecture/Tute	Lecture/Tute
9.45–10.00	Break	Break
10.00 – 12.30	Practical Class Expt.1	Practical Class Expt.3
12.30 – 1.30	Lunch	Lunch
1.30– 2.30	Lecture/Tute	Lecture/Tute
2.30-2.45	Break	Break
2.45– 5.15	Practical Class Expt.2	Practical Class Expt.4

\* Day 1 begins at 9.00 am in Land Resource Lecture Theatre No.1 (LR-1) – See *Chemistry Venues* at the back of this Unit Outline.

### **Laboratory Notes**

You will be sent printed copy of *Laboratory Notes* (= prac manual) in the res school once the dates of the residential school are arranged.

## **Examination** – optional, free

**You need to contact unit coordinator in order to arrange examination between you and the coordinator, when you have finished all the six sets of assignments.**

Examination covers all the assignments roughly equally. Examination questions are based on the assignment questions. Most people, who have completed assignments, normally perform very well in the examination.

See past exam papers on CHEM123S CD as models.. As in the past exam papers, necessary numerical data will be provided in each exam question and a periodic table will be located at the end of the examination paper.

### **“Summary” sheet and a calculator to the examination**

You will be allowed to bring your own “summary” of CHEM123S on just one A4 sheet to the examination. You can write, print, photocopy, paste and draw anything you like on both sides of the “summary” sheet.

This is to promote **understanding** of the textbook contents as you study the textbook, instead of memorising them. If you felt you must memorise anything, jot it down on the “summary” sheet and bring the “summary” sheet to the examination.

You should also bring a calculator to the examination.

For successfully finishing CHEM123S,

You should set up your own study schedule, which suits your life style. We'd suggest you to cover one or two chapters of the textbook every week, and attempt one assignment question everyday.

The unit coordinator is **your personal tutor** for studying CHEM123S. Feel free to contact unit coordinator, Kiyoo Fujimori, for any smallest questions, queries or, problems in CHEM123S any time in order to be successful in CHEM123S.

Leave message on his phone (02-6773-2402), if he is out of room.

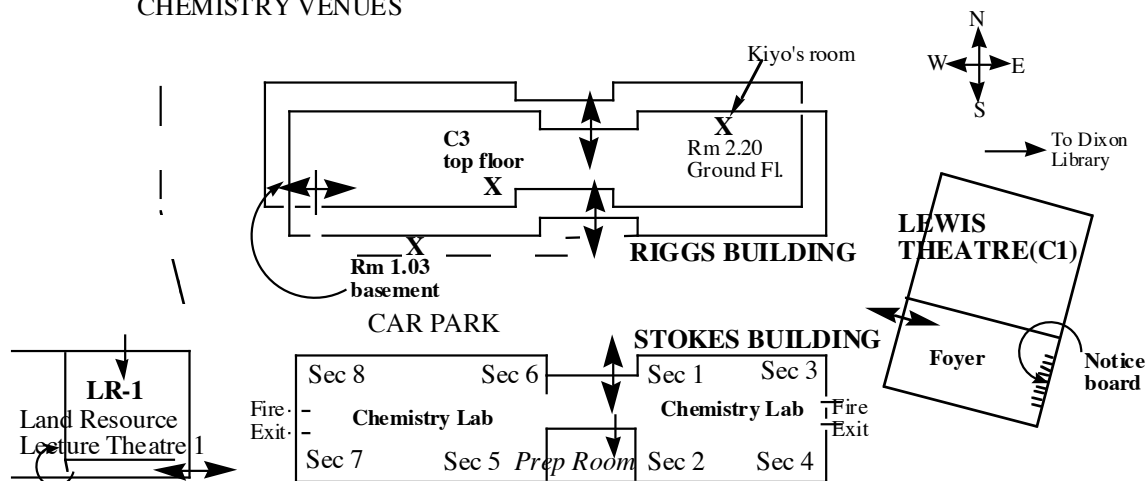
E-mail: [Kiyoo.Fujimori@une.edu.au](mailto:Kiyoo.Fujimori@une.edu.au)

Good key words: "understanding concepts",  
"textbook Examples",  
"attempting assignment question immediately after a textbook Example",  
"staying with your own *Study Schedule*".  
Using your personal tutor, the unit coordinator.

Bad key words: "memorising items",  
"indulging in details",  
"perfectionist attitude"

## Chemistry venues

### CHEMISTRY VENUES



# Objectives and syllabus of CHEM123

## General Objectives of CHEM123

Specific learning goals for all modules in this course are given at the beginning of each module. You should check these, before and after you study each module, to make sure you have satisfied each goal.

Besides these specific objectives, you should also be aware of the more general objectives of this course. After you have completed this course you should be able to:

- Understand basic chemical concepts concerning energy and matter, chemical reactions, chemical composition and quantities, atomic structure and bonding, states of matter, equilibrium, acids and bases, redox and electrochemistry,
- Apply relevant information, equations and mathematical techniques to solve basic problems involving the above concepts.
- Communicate your ideas clearly and concisely to discuss and explain basic chemical concepts. This includes spoken, written and graphical means of communication.
- Collect, organise, interpret and analyse data from simple chemical experiments.
- Evaluate yourself accurately in your level of success in understanding chemical concepts and solving problems in this Course. This self evaluation to be done by various means, such as self test questions, identifying successful problem solving strategies, acting on assignment feedback and working through sample exam questions.
- Make progress towards acting as an ethical and informed professional. This involves developing an attitude of intellectual curiosity and independent learning and understanding the values and attributes of a profession and its role in society.

## Syllabus Outline

Testbook: Zumdahl, S.S., "Introductory Chemistry", 6<sup>th</sup> edition, Houghton-Mifflin.

### MODULE 1

#### Chapter 1 Introduction

What is Chemistry? Solving Problems; Using a Scientific Approach; The Scientific Method; Learning Chemistry

#### Chapter 2 Measurements and Calculations

Scientific Notation; Courses; Measurements of Length, Volume and Mass; Uncertainty in Measurement; Significant Figures; Problem Solving and Dimensional Analysis; Temperature Conversions - An Approach to Problem Solving; Density

#### Chapter 3 Matter and Chapter 10 Energy

Matter; Physical and Chemical Properties and Changes; Elements and Compounds; Mixtures and Pure Substances; Separation of Mixtures; Energy and Energy Changes

### MODULE 2

#### Chapter 4 Chemical Foundations: Elements and Atoms

The Elements; Symbols for the Elements; Dalton's Atomic Theory; Formulas of Compounds; The Structure of the Atom; Introduction to the Modern Concept of Atomic Structure; Isotopes; Introduction to the Periodic Table

#### Chapter 5 Elements, Ions and Nomenclature

Natural States of the Elements; Ions; Compounds That Contain Ions; Naming Compounds; Naming Compounds That Contain a Metal and a Nonmetal; Naming Binary Compounds That Contain Only Nonmetals (Type III); Naming Binary Compounds - A Review; Naming Compounds That Contain Polyatomic Ions; Naming Acids; Writing Formulas from Names

#### Chapter 6 Chemical Reactions: An Introduction

Evidence for a Chemical Reaction; Chemical Equations; Balancing Chemical Equations

### MODULE 3

#### Chapter 7 Reactions in Aqueous Solutions

Predicting Whether a Reaction Will Occur; Reactions in Which A Solid Forms; Describing Reactions in Aqueous Solutions; Reactions That Form Water - Acids and Bases; Reactions of Metals with Nonmetals (Oxidation - Reduction); Ways to Classify Reactions; Other Ways to Classify Reactions

### ***Chapter 8 Chemical Composition***

Counting by Weighing; Atomic Masses - Counting Atoms by Weighing; The Mole; Molar Mass; Percent Composition of Compounds; Formulas of Compounds; Calculation of Empirical Formulas; Calculation of Molecular Formulas

### ***Chapter 9 Chemical Quantities***

Information Given by Chemical Equations; Mole-Mole Relationships; Mass Calculations; Calculations Involving a Limiting Reactant; Percent Yield

## **MODULE 4**

### ***Chapter 11 Modern Atomic Theory***

Electromagnetic Radiation and Energy; The Energy Levels of Hydrogen; The Bohr Model of the Atom; The Wave Mechanical Model of the Atom; The Hydrogen Orbitals; The Wave Mechanical Model - A Summary; Electron Arrangements in the First Eighteen Atoms; Electron Configurations and the Periodic Table; Atomic Properties and the Periodic Table

### ***Chapter 12 Chemical Bonding***

Types of Chemical Bonds; Electronegativity; Bond Polarity and Dipole Moments; Stable Electron Configurations and Charges on Ions; Ionic Bonding and Structures of Ionic Compounds; Lewis Structures; Lewis Structures of More Complex Molecules; Molecular Structure

## **MODULE 5**

### ***Chapter 13 Gases***

Pressure; Pressure and Volume - Boyle's Law; Volume and Temperature - Charles's Law; Volume and Moles - Avogadro's Law; The Ideal Gas Law; Dalton's Law of Partial Pressures; Laws and Models - A Review; The Kinetic Molecular Theory of Gases; The Implications of the Kinetic Molecular Theory; Gas Stoichiometry

### ***Chapter 14 Liquids and Solids***

Water and Its Phase Changes; Energy Requirements for the Changes of State; Intermolecular Forces; Evaporation and Vapour Pressure; The Solid State - Types of Solids; Bonding in Solids

### ***Chapter 15 Solutions***

Solubility; Solution Composition - An Introduction; Solution Composition - Mass Percent; Solution Composition - Molarity; Dilution; Stoichiometry of Solution Reactions; Neutralization Reactions

## **MODULE 6**

### ***Chapter 16 Acids and Bases***

Acids and Bases; Acid Strength; Water as an Acid and a Base; The pH Scale; Calculating the pH of Strong Acid Solutions; Buffered Solutions

### ***Chapter 17 Equilibrium***

How Chemical Reactions Occur; Conditions That Affect Reaction Rates; The Equilibrium Condition; Chemical Equilibrium - A Dynamic Condition; The Equilibrium Constant - An Introduction; Heterogeneous Equilibria; Le Chatelier's Principle; Applications Involving the Equilibrium Constant; Solubility Equilibria

### ***Chapter 18 Oxidation - Reduction Reactions and Electrochemistry***

Oxidation - Reduction Reactions; Oxidation States; Oxidation - Reduction Reactions Between Nonmetals; Balancing Oxidation - Reduction Reactions by the Half - Reaction Method; Electrochemistry - An Introduction; Batteries; Corrosion; Electrolysis