

DEPARTMENT OF **CHEMISTRY**

CHEM UG Courses

UG Courses offered in Fall Term 2020-2021

Course Code	Course Title
CHEM 1010	General Chemistry 1A
CHEM 1020	General Chemistry 1B
CHEM 1030	General Chemistry II
CHEM 1050	Laboratory for General Chemistry I
CHEM 2110	Organic Chemistry I
CHEM 2150	Organic Chemistry Laboratory
CHEM 2155	Fundamental Organic Chemistry Laboratory
CHEM 2210	Inorganic Chemistry I
CHEM 2250	Inorganic Chemistry Laboratory
CHEM 2310	Fundamentals of Analytical Chemistry
CHEM 2350	Analytical Chemistry Laboratory
CHEM 2355	Fundamental Analytical Chemistry Laboratory
CHEM 2409	Mathematical Methods for Physical Chemistry
CHEM 2410	Physical Chemistry I: Equilibrium Thermodynamics and Statistical Mechanics
CHEM 2450	Physical Chemistry Laboratory
CHEM 4120	Biomolecular Chemistry
CHEM 4140	Intermediate Organic Chemistry
CHEM 4210	Solid State Chemistry
CHEM 4220	Materials Chemistry

CHEM 4240	Intermediate Inorganic Chemistry
CHEM 4320	Environmental Analytical Chemistry
CHEM 4340	Bioanalytical Techniques
CHEM 4410	Physical Chemistry in Biological Applications
CHEM 4689	Capstone Project
CHEM 4691	Capstone Research I

The Hong Kong University of Science and Technology
Department of Chemistry

Instructor: Dr. Emily M. W. Tsang

Office: Rm 4536 (Lift 25/26)

E-mail: chetsang@ust.hk

CHEM 1010 – General Chemistry IA (3-credits)

Fall 2020 -2021

Course Description:

This course targets students who have learnt the basic knowledge of Chemistry in high school, and is the Part I of a two-semester course 'General Chemistry'. Key topics covered include atoms, atomic structures, chemical bonds, molecules, molecular structures, substances, chemical kinetics, and energy.

Pre-requisites: *Level 3 or above in HKDSE 1/2x Chemistry OR CHEM 1004*

Exclusions: *Level 3 or above in HKDSE 1x Chemistry, CHEM 1008, CHEM 1020*

Lecture: Tuesday and Thursday, 13:30 – 14:50 through ZOOM meetings (details on CANVAS)

Instructor Office Hours: By email.

Textbook: *Chemistry: An Atoms First Approach*, 3rd Asian Ed. S.S. Zumdahl; S. A. Zumdahl; D. DeCoste © Cengage Learning. ISBN: 9789814896993

Course Content/Topics:

- ☐ Chapter Review: Measurement and Calculations in Chemistry
- ☐ Chapter 1: Chemical Foundations
- ☐ Chapter 2: Atomic Structure and Periodicity
- ☐ Chapter 3: Bonding - General Concepts
- ☐ Chapter 4: Molecular Structure and Orbitals
- ☐ Chapter 5: Stoichiometry
- ☐ Chapter 6: Types of Chemical Reactions and Solution Stoichiometry
- ☐ Chapter 7: Chemical Energy
- ☐ Chapter 8: Gases

Intended Learning Outcomes:

Upon successful completion of this course, students are expected to be able to:

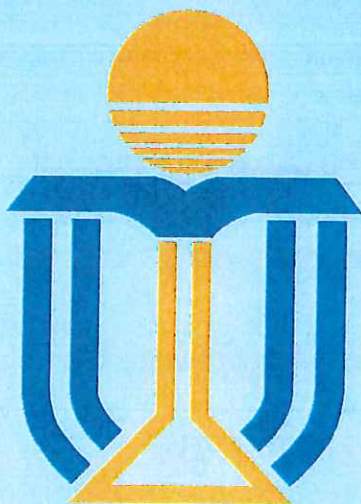
1. Describe and apply fundamental principles and terminologies of chemistry.
2. Develop a microscopic view of the world in terms of atoms and molecules and their change
3. Describe and apply concepts of mass conservation and energy conversation in chemical changes.

4. Describe the atoms and ions in terms of atomic structure, atomic orbitals, electron configuration, and periodicity of chemical properties
5. Describe molecules in terms of bonding theory, energy, molecular geometry and interactions.
6. Describe a chemical reaction from an equilibrium, thermodynamic and kinetics point of views.
7. Describe the physical states of matters: gases, liquids and solids.
8. Recognize and appreciate the impact of chemistry to our society.

Course Grading Scheme

Quiz 1	10 %
Quiz 2	10 %
Midterm Exam	40 %
Final Exam	40 %

Welcome to HKUST!



Welcome to Chem1020!

CHEM 1020 General Chemistry IB (Fall 2020)

Instructor (1):

Name:	Guochen JIA
Office:	CYT 6009
Email:	chjiag@ust.hk
Phone #:	2358 7361
Office hour:	Friday, 14:00 – 15:00

CHEM 1020 General Chemistry IB (Fall 2020)

Instructor (2):

Name: Xiaoyuan LI
Office: RM 4516
Email: chxyli@ust.hk
Phone #: 2358 7356



CHEM 1020 General Chemistry IB (Fall 2020)

Instructional Assistant (The I.A.):

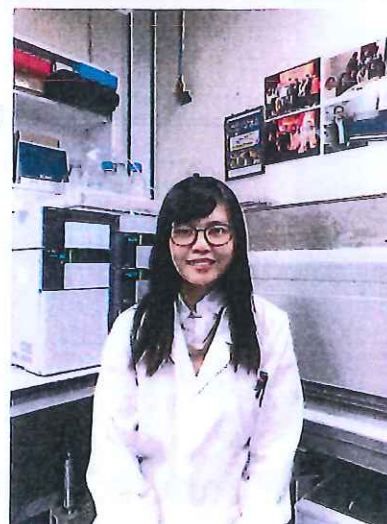
Name: Miss Elaine, WONG Yee Lam

Office: RM 4524

Email: wylelaine@ust.hk;

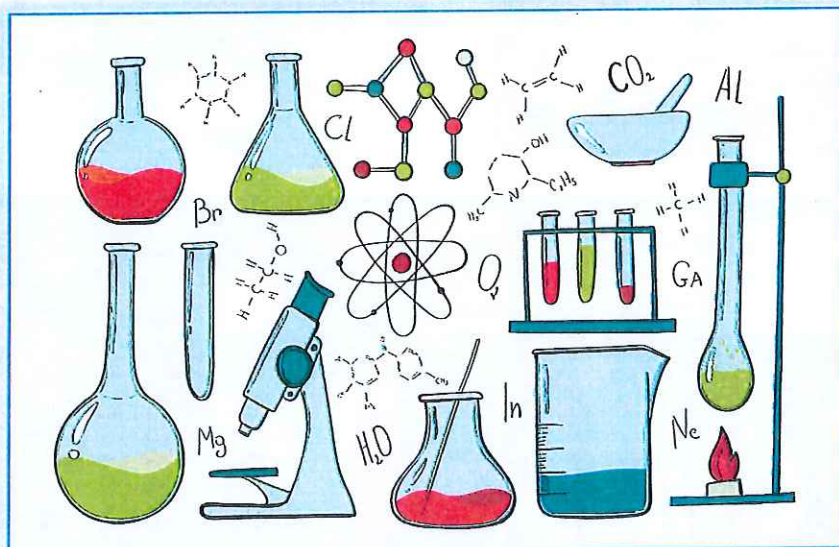
Phone #: 2358 7243

Office hour: Wednesday, 14:30 – 15:30



Course Objectives

- **Chemistry** is a science that studies **composition**, **structure**, **properties**, and **the changes (reactions)** of matter.

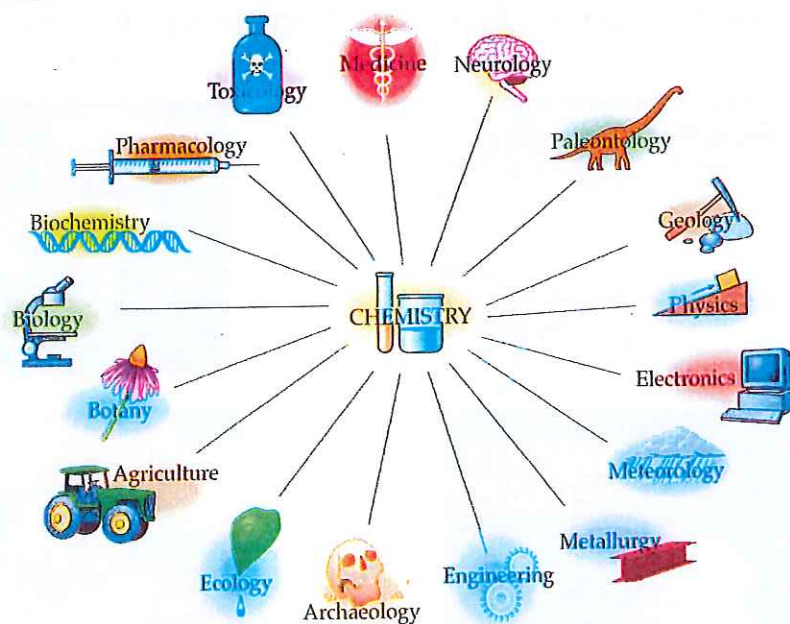


Chemistry and Life

We encounter and use chemicals every day.



Chemistry: Its Central Role

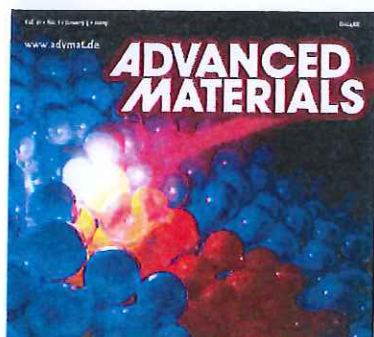
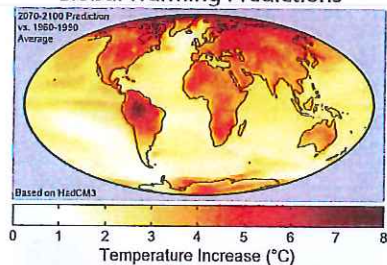


Chemistry is a central science. It is related to many modern technologies and industries.

Chemistry and Future

Many problems require chemistry knowledge to resolve, e.g.

Global Warming Predictions



Course Objectives

- **To introduce fundamental concepts and principles of chemistry.**
- **To prepare you for further study in other chemistry-related subjects in Science and Engineering.**
- **Key topics: atomic structures, bonding theories, thermochemistry, solution chemistry, properties of gas, liquid and solid.**

Course Outline

Chapter 1. Chemical Foundations

Chapter 2. Atomic Structure and Periodicity

Chapter 3. Bonding: General Concepts

Chapter 4. Molecular structure and orbitals

Chapter 5. Chemical Stoichiometry

Chapter 6. Chemical reactions in aqueous solution

Chapter 7. Thermochemistry: Chemical Energy

Chapter 8. Gases

Chapter 9. Liquids and solids

Knowledge/Content Related Learning Outcomes

At the end of the course, students are expected to be able to:

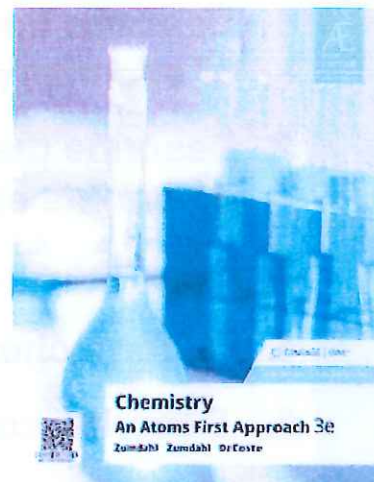
1. Describe and apply elementary concepts and terminologies of chemistry
2. Describe the structure of atoms and periodicity, and determine electron configurations.
3. Describe and apply the primary concepts of bonding theory.
4. Perform chemical stoichiometric calculations.
5. Describe common reactions in aqueous solutions.
6. Describe and apply the basic concepts of thermochemistry.
7. Describe properties of gases, liquids and solids

Textbook

Title: "Chemistry: An Atoms First Approach"
3rd Ed (Asia edition); 2021

Authors: Steven S. Zumdahl,
Susan A. Zumdahl &
Donald J. DeCoste

Publisher: Cengage Learning



Note:

- ✓ Both hardcopy and e-book are available for purchasing.
- ✓ Two copies are on-reserve in the HKUST library.

Lecture Notes and Videos

Lecture Notes:

- Lecture-note will be posted on the **CANVAS** system [<https://canvas.ust.hk>].

Lecture Video:

- All lectures are video tapped.
- Available on Chem-1020 site on the **CANVAS** system.

Tutorials

- *Two tutorial sessions will be offered.*
- *One before Mid-Term Exam and one before Final Exam*
- *Instructed by instructional assistant.*

Note: The exact date, time and venue for the tutorial class will be announced in due course.

Homework (HW)

- Questions are selected from end-of-chapter exercises in your textbook.
- They will not be graded.
- Model-Answers for HWs will be posted on the CANVAS system.



Assessment and Grading

- **Midterm Exam** **50%**
- **Final Exam** **50%**

Information regarding **Midterm Exam**

- **Tentative Time for Mid-Term Exam:**
 - ✓ **19:00-21:00 pm, 2/11/2020**
- **Coverage**
 - ✓ **Chapters 1-4**
- **Format of the questions:**
 - ✓ **All the questions are in the form of Multiple Choice(MC)**
- **Homework (HW) and midterm Exam**
 - ✓ **~ 20% of the Problems/Questions in the exam are randomly selected from HW.**



CHEM 1030 (L1) General Chemistry II

Fall Semester 2020-2021

3 credits

Lectures:	Wednesdays and Fridays 4:30 – 5:50 PM Online Zoom Delivery No Lecture on 2 Oct (public holiday)
Instructor:	Prof. K. K. Jason Chan Assistant Professor of Science Education Department of Chemistry Email: kkjchan@ust.hk Office: Rm 4543, 4/F, Lift 25/26
Teaching Assistants:	Mr Wenhao FU email: wfuag@connect.ust.hk Mr Vince St. Dollente MESIAS email: vsdmesias@connect.ust.hk
Course website:	Canvas course site https://canvas.ust.hk

Course Description

This course is for students who have taken or are also taking General Chemistry I. It is a foundational Chemistry course that build up an understanding of Chemistry for more advanced higher level courses.

There will two parts to this course: *Understanding chemical reactions* and *Chemistry of the Elements*. The first part will be consisted of 5 chapters, while the second part will be consisted of 3 chapters.

Part 1: Understanding chemical reactions

Chapter 1	Chemical thermodynamics
Chapter 2	Chemical equilibrium
Chapter 3	Solubility and solution properties
Chapter 4	Acids and bases
Chapter 5	Chemical kinetics

Part 2: Chemistry of the elements

Chapter 6	The main group elements
Chapter 7	Transition metals
Chapter 8	Redox and Electrochemistry

Course materials

(1) Lecture Notes

A set of lecture notes will be provided for each chapter of the course. These notes will be the main teaching materials. The lecture notes for the upcoming Chapter will be uploaded to Canvas towards the end of a chapter. Please download them and either print them out to write notes on them or use them in a digital format that has hand-written note-taking capability.

There are blanks to be filled in and exercises to be completed during the lectures within the notes, so please attend the lectures to ensure you can follow the progress and not miss out on important parts.

(2) Presentation Slides

The lectures will be delivered with the use of some ppt slides. The slides contain both the content from the lecture notes and additional information. Slides are used for more visual presentation and the additional information in the slides provide more context or supplementary information to the course. The content of the slides are also examinable, unless the slides are clearly marked as 'not for exam'. A PDF of the slides will be uploaded to Canvas after each lecture and they will contain any hand-written notes of the lecturer from the class.

(3) Textbook

This course is the continuation of General Chemistry I, and the same textbook is adopted as our reference: *Chemistry: An Atoms First Approach* (Steven Zumdahl and Susan Zumdahl). It is optional on whether you purchase the textbook as we will not be using the textbook directly during the course.

The course will not follow the exact contents, or the order of this textbook, but you can find the corresponding chapters in Zumdahl & Zumdahl's on the cover page of each set of lecture notes. This textbook can be useful to supply more practice questions with answers provided at the back, however it is often helpful to also consult some other books that can provide better quality explanation. These books or internet resources will be provided to you on Canvas by Chapter, please make use of these resources to go deeper on the topics if you are interested.

(4) Practice exercises and on-demand tutorial

At the end of each chapter, a set of practice exercises will be provided. These are not graded and they are meant to be your homework to be completed at your private study time.

Tutorial classes on these exercise questions will be provided by pre-recorded tutorials, given by the instructor. You can watch the tutorial class after completing the exercise to check your answers. To ask further questions, you can contact the instructor or a TA by email or to arrange for an office hour.

Graded Assessments

The course grade will be computed from three assessments carrying different weighting:

- Four graded quizzes	20 %
- Mid-term examination	30 %
- Final examination	50 %

A letter grade (A+ to F) will be given to the course, with reference to the university grades distribution guidelines.

(1) Graded quizzes 20 %

There will be a graded quiz at the end of every two Chapters, i.e. a total of four graded quizzes. Each graded quiz will count towards around 5 % of the course grade, giving a total of 20 % from the 4 quizzes. These quizzes are designed to be a revision or concept check of your understanding and they should be treated as a learning opportunity.

Graded quizzes will be arranged on Canvas in a digital format. There will be a window of around 10 days to complete each quiz. When a quiz becomes available, you will be notified by email with the details, and the lecturer will announce this in the class.

(2) Mid-term examination 30 %

A mid-term examination will take place on **23 Oct (Friday)** (13th lecture). The exam will be arranged online on Canvas at the usual lecture time, and will cover the contents of the course up to and including the lecture on 16 Oct (Friday).

The mid-term exam will be in an open-book format. More details regarding the mid-term exam will be provided closer to the date.

(3) Final examination 50 %

The final exam will take place during the final examination period on a date and time arranged by the Academic Registry. In this semester, we are likely to continue with an open-book format online exam.

This final exam will cover all contents for the entire course, including those parts already covered in the mid-term exam. It will include questions that require knowledge across the Chapters to test your understanding. Of course, there will be a heavier focus on the latter parts of the course, but you should be prepared to be required to make use of knowledge learned in the earlier parts.

Office Hours

The instructor will be available for consultation by appointment. Please email Prof. Chan to request an office hour meeting by Zoom meeting or in person at his office.

Learning Outcomes

On completion of the course, students will be able to:

1. Analyse properties of solutions and determine stoichiometry of chemical transformations.
2. Describe different definitions of acids and bases theories and understand acid-base equilibrium.
3. Apply the laws of thermodynamics and account for the factors that lead to spontaneous physical and chemical changes.
4. Describe redox reactions, use electrochemical data to predict the spontaneity of redox reactions, and comprehend the structures of electrochemical cells.
5. Describe and explain the trends and patterns of structures, physical properties and reactivities of selected main group compounds, transition metal compounds.
6. Recognize the impact of chemistry to society.

CHEM 1050 Laboratory for General Chemistry I

2020–21 Fall

Course Outline

Instructor

Dr. CHEUNG Man Sing (Rm4535; Tel: 2358 7401; Email: sing@ust.hk)

Instructional Assistants (IAs)

Ms. CHEUNG Ruby S. W. (Rm4522; Tel: 2358 8450; Email: rubycheung@ust.hk)

Ms. WONG Cherry C. T. (Rm4523; Tel: 3469 2080; Email: cctwong@ust.hk)

Technical Officers

Mr. SEETO K. (Rm4531; Tel: 2358 7371; Email: chkseeto@ust.hk)

Mr. TSE M. L. (Rm4531; Tel: 2358 7371; Email: mltse@ust.hk)

Class Schedule

<u>Section</u>	<u>Date</u>	<u>Time</u>	<u>Online Platform</u>
LA1	Monday	10:30AM – 01:20PM	Canvas & Zoom
LA2		01:30PM – 04:20PM	
LA3	Tuesday	10:30AM – 01:20PM	
LA4		01:30PM – 04:20PM	
LA5	Wednesday	10:30AM – 01:20PM	
LA6		01:30PM – 04:20PM	

Course Information

Credit Units: 1

Pre-requisite: Level 3 or above in HKDSE 1/2× Chemistry OR level 3 or above in HKDSE 1× Chemistry OR CHEM 1004

Co-requisite: CHEM 1010 OR CHEM 1020

Exclusion: Nil

Grade: P/F

Description:

This course is the laboratory class designed for students who enrolled in CHEM 1010 or CHEM 1020. With laboratory experience acquired in this course, students will be able to relate the physical and chemical principles and theories in practice.

Intended Learning Outcomes

Upon successful completion of this course, students should be able to:

Knowledge/Content Related:

1. recognize various kinds of equipment in chemistry laboratory
2. conduct standard laboratory procedures involved in basic chemistry experiments

Academic Skills/Competencies:

3. conduct risk assessments concerning the use of chemicals in basic chemistry experiments
4. keep records of experimental work in basic chemistry experiments
5. interpret experimental results for physical and chemical phenomena in basic chemistry experiments

Assessment Scheme

<u>Assessment</u>	<u>Assessing Course ILOs</u>
Tests and Lab Quizzes	1, 2, 3
Lab Reports	4, 5

To pass the course, students have to get satisfactory performances in all abovementioned assessment tasks/activities.

Student Learning Resources

- Reference Book: James Hall, *Experimental Chemistry: An Atoms First Approach*, Brooks/Cole, Cengage Learning, 2012.
- Other learning resources can be accessed through Canvas.

Teaching and Learning Activities

Laboratory Demonstration: focus on experiments related to co-requisite course

Course Schedule

Keyword Syllabus:

- Laboratory safety
- Common laboratory apparatus
- Basic techniques for measurements in chemistry laboratory
- Gas law
- Boiling point and intermolecular forces
- Solution stoichiometry and volumetric titration
- Chemical energy and calorimetry