CHEM 1004 – Chemistry in Everyday Life

School:	**School of Science**
Subject Area:	**Chemistry**
Course Credit:	**3**
Instructor:	**SHEONG Frederick Fu Kit, TSANG Ming Wai Emily**
Pre-requisite/co-requisite:	**Nil**

Notes:

- The syllabi provided here is for reference only and may be subject to changes and adjustments as determined by the course instructors.

香港科技大學
THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

CHEM 1004 – Chemistry in Everyday Life

Spring Semester 2024-25

3 credits

Lectures:	G009A (CYT Building) Wednesday and Friday 15:00 – 16:20 No lectures on Apr 4, 18
Course Instructor:	**Prof. Emily M.W. TSANG** Assistant Professor of Science Education Department of Chemistry, HKUST Email: **chetsang@ust.hk** Office: Rm 4536 (4/F, between Lifts 25/26 and 27/28)
Course website:	**https://canvas.ust.hk**

Course Description

CHEM 1004 is an introductory course provided for students who have never taken a Chemistry course, but would like to learn what chemistry is and how it may affect the world we live in.

Course objectives are as follows:
1. Introduce basic concepts of Chemistry.
2. Connect Chemistry with everyday life and modern technology.
3. Explain the importance of Chemistry in the environment, medicine, and daily life.

Course Outline

The course is divided into six Chapters:

Chapter 1:	What is everything made of?
Chapter 2:	The Air.
Chapter 3:	The air and our environment.
Chapter 4:	The metals in our daily life.
Chapter 5:	Metals in the industry.
Chapter 6:	Fire and fuels.

Lectures

The lectures are critical to your understanding of course materials. You should try to attend all the lectures. We will show some interesting experiments during some of the classes and they are best viewed in person. Lecture recordings will be provided on Canvas after **each class**, so please catch up promptly when you missed a class.

Course Contents

Comprehensive **lecture notes** will be provided for this course. These notes should be very helpful to you as they provide more details of the lecture materials than power point slides. However, the version of the notes you receive is incomplete. You will need to fill in some important details or draw diagrams to complete the notes during the lectures.

You should print out hard copies of the lecture notes and bring them to the class. You can staple each chapter's notes into a booklet.
It would be advisable to print them single sided, so that you can use the blank page to jot down extra notes that the lecturer mentions but are not in the notes, or to write some references you obtained from other sources or your revision notes.

The **power point slides** will be mostly pictures or graphics. The slides will be released on Canvas.

The lecture notes will be released by chapter. New chapters will be released on Canvas towards the end of the current chapter. You can read through the notes before the lecture to familiarise yourself with the materials.

Textbooks/Reading List

You don't need a textbook for this course, and since we draw examples from many different areas of chemistry in everyday life, no one textbook is a perfect fit for the course. Therefore for each chapter, some reading materials will be suggested to you for optional reference.

End of Chapter Exercises and Tutorial Sessions

To help you prepare for the examination, each chapter will finish with a short **exercise**. These exercises will require you to work through a set of problems, using some knowledge from the lectures and also to teach you some new knowledge through the exercise.

These exercises will not be formally graded, but they will be examinable.

Office Hours of the Instructor

Please feel free to approach the instructor, Prof. Emily Tsang to ask questions or to discuss any chemistry or course-related issues. You may approach her after the lectures, or you may email her to arrange an appointment. There is no fixed office hour schedule: if you need one, feel free to email and book a time.

Online Graded Quizzes (15 % of the course)

There will be two online graded quizzes in addition to the end-of-chapter exercises, the first quiz is **after Chapter 4** (covering Chapters 1 – 4), and the second quiz is at the end of the course (covering mainly Chapters 5 – 6). You should complete them within the given time (typically 2 – 3 days). The accumulated points from the online quizzes will carry 15 % to the course grade, but the main purpose

is to help you further understand the course materials and have a chance to practice and receive answers immediately after submission. When these quizzes are available, you will receive email notification as well as instructions during the lectures.

Individual Study-Project (30 % of the course)

This course will have a study project component for you to learn more about a particular area of everyday chemistry that interests you. The project period will commence about 3 weeks into the course. In view of the time needed for this project, **there will be no mid-term examination** for this course.

Every student will undertake an *individual* written study project. At the end of the project, each student should submit a piece of written original research. You will choose a topic yourself that is about any chemistry phenomenon or chemicals that is in your everyday life. Be creative and explore interesting topics!

You are expected to read widely, using resources available to you, not limited to the internet – you also have access to books, journal articles and other multimedia resources. You may report also real experiences yourself and report them. Photographs would be needed to demonstrate that your topic is truly something you can connect to in the real world.

The article should bring together many ideas to draw up an original story. Originality checks will be performed so you must do the writing yourself.

More information will be announced during a lecture around week 3.

Final Examination (55 %)

On-campus proctored examination during the final exam period: This course will end with a *closed-book* final examination (2 hours). This will cover all the lecture materials and exercises that were taught in the course. You will mainly be tested on your understanding and ability to solve problems rather than solely on the memorisation of facts, but you should also be familiar with some key chemical details – some of these will inevitably require some memorisation.

Grades

The final grade for the course will be consisted of:
15% from the Online Quizzes
30% from the Study Project
55% from the Final Examination
The course is graded from A+ to F. An F grade will not earn you credits for the course.

Intended Learning Outcomes (ILOs)

At the end of the course, the students will have:

1. An ability to recognize physical/chemical properties, physical/chemical changes.
2. An ability to apply knowledge of chemical reactions, stoichiometry, atomic structure, chemical bonding, molecular structure, states of matter, acid-base chemistry, and redox reactions.
3. A basic knowledge of organic chemistry, polymer chemistry, biochemistry, and food chemistry.
4. An ability to link chemistry to modern technology, environment, and daily life.

Assessment Scheme

Weight	Assessment	Course ILOs	CHEM Program ILOs
15%	**Online Revision Quiz**	**1, 2, 3, 4**	**1, 2, 3**
30%	**Study Project**	**1, 2, 3, 4**	**3, 6, 11, 12, 13**
55%	**Final Exam**	**1, 2, 3, 4**	**1, 2, 3**

Teaching and Learning Activities (Non-assessed)

Activities	Course ILOs	CHEM Program ILOs
Lecture	**1, 2, 3, 4**	**1, 2, 3**
End of chapter exercises and Tutorials	**1, 2, 3, 4**	**1, 2, 3**

Topics by Chapter

Chapter 1: What is everything made of?	**~2 Lectures**	Introduction of the course Discovery of the atomic structure Elements; relative atomic mass relative molecular mass The mole Chemical calculations Relationship between mole and mass, mole and concentration, mole and gas volume Calculations, Common elements
Chapter 2: The Air	**~3 Lectures**	Gases in the Air, Electronic configuration Forming covalent bonds States of matter, separation of gases in air, Intermolecular forces: London dispersion force Electronegativity, Polar and non-polar molecules, Intermolecular forces: dipole-dipole interactions
Chapter 3: The air and our environment	**~5 Lectures**	Electromagnetic waves Greenhouse gases, Greenhouse effect, Global Warming, Carbon cycle, Reducing CO_2 emission Acids and Bases Air Pollution: Acid Rain and other air pollutants Reading organic chemical structures Air Pollution: VOCs, smog, PMs Controlling air pollution

		Ozone and ozone depletion
Chapter 4: The metals in our daily life	**~5 Lectures**	Different groups of metals in the periodic table: Alkali metals, Alkaline earth metals, Transition metals, Lanthanides, metals in Group 13-15, Radioactivity and the Actinide elements Structure of Metals, Metallic bonding Metal lattice systems Physical properties of typical metals; Alloys Alloys: types and applications Compounds of metals: Ionic bonding Name and Formula of ionic compounds Structure of complex ions Solid structure of ionic compounds Ionic lattice systems Physical properties of ionic compounds Reaction of metals with oxygen Reaction of metals with water Reaction of metals with acids
Chapter 5: Metals in the industry	**~6 Lectures**	Metal extraction industry Calculate %mass of metal in a compound Redox Oxidation number Metal displacement reactions Metal displacement reactions Extraction of Metals by heating with carbon: Copper, Iron (Blast Furnace, Basic Oxygen Converter) Electrolysis of molten ionic compounds: Extraction of sodium Electrolysis of molten ionic compounds: Extraction of aluminium Electrolysis of aqueous solution The chloroalkali industry

		The refining of copper metal Electroplating Anodising aluminium Half cells and standard electrode potentials Electrochemical cells Fruit batteries, zinc-carbon batteries Alkaline batteries Silver oxide cells Rechargeable batteries: Ni-MH batteries Lithium metal batteries Lithium-ion batteries
Chapter 6: Fire and fuels	**~4 Lectures**	Fire and combustion, Fire triangle How to fight a fire Fire extinguishers Introduction to fossil fuels: coal, natural gas and crude oil Alkanes: naming and isomers Fractional distillation of crude oil Fractions from crude oil Cracking Alkenes Polymers Calculating energy from combustion reactions Starting a fire Fireworks Explosives