

<b>Module Code</b>	CHU11E05
<b>Module Name</b>	Chemistry
<b>ECTS Weighting<sup>1</sup></b>	5 ECTS
<b>Semester taught</b>	Semester 1
<b>Module Coordinator/s</b>	Asst. Prof. Richard Hobbs
<b><a href="#">Module Learning Outcomes</a> with reference to the <a href="#">Graduate Attributes</a> and how they are developed in discipline</b>	<p>On successful completion of this module, students should be able to:</p> <p>LO1. Explain chemical equations, balance them, and make calculations based on them relating to stoichiometry and molarity;</p> <p>LO2. Relate trends in the periodic table (in both elements and their compounds) with the underlying trends in electronic and atomic structure;</p> <p>LO3. Perform calculations on the rates of reaction and to relate reaction kinetics to the details of the reaction mechanism;</p> <p>LO4. Perform calculations on chemical equilibria of different nature (acid-base, complexation, gas reactions, solubility, etc.);</p> <p>LO5. Be able to read and interpret basic phase diagrams of pure substances and binary mixtures;</p> <p>LO6. Explain the properties of ideal and near-ideal solutions and carry out calculations using colligative properties;</p> <p>LO7. Perform calculations of electrochemical potentials and relate them to thermodynamic quantities;</p> <p>LO8. Explain chemical reactivity (thermodynamic and kinetic) in terms of valency, electronegativity and electronic structure;</p> <p>LO9. Relate some of the macroscopic properties of materials to the nature of the electronic structure and bonding at the molecular/atomic level;</p> <p>LO10. Carry out basic experimental procedures on aspects of chemical reactions and to appreciate the need for safety and safety procedures in the laboratory.</p> <p><b>Graduate Attributes: levels of attainment</b></p> <p>To act responsibly - Introduced</p> <p>To think independently - Introduced</p> <p>To develop continuously - Introduced</p> <p>To communicate effectively - Introduced</p>

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<sup>1</sup> [TEP Glossary](#)

## Module Content

### Introduction and General Chemistry

- Chemical change; elements, compounds and mixtures; atomic theory; stoichiometry and chemical equations; atomic structure; electronic structure and the periodic table; bonding; elementary structural chemistry; metals, semiconductors and insulators.

### Physical Chemistry I

- Thermodynamics: First law, internal energy, enthalpy; introduction to entropy, 2nd and 3rd Laws; criterion for chemical change; equilibrium constant for a chemical reaction, Gibbs free energy.

### Physical Chemistry II

- States of matter: Gibbs phase rule, ideal solutions, colligative properties
- Chemical Equilibrium: Law of mass action; factors that influence the position of equilibrium. Ionic equilibria: ionic equilibria in aqueous solutions; strong and weak acids and bases; buffer solutions and indicators;
- Electrochemistry; molar conductivity and electrolyte solutions; electrode potentials; cells; electrolysis; emf and chemical equilibrium; and introduction to analytical chemistry;
- Chemical Kinetics: rates of reactions; order and molecularity; activation energy; kinetics and mechanisms; catalysis.

## Teaching and Learning Methods

This module is taught using a combination of lectures, tutorials and laboratory-based experiments.

<b>Assessment Details<sup>2</sup></b> <b>Please include the following:</b> <ul style="list-style-type: none"> <li>• <b>Assessment Component</b></li> <li>• <b>Assessment description</b></li> <li>• <b>Learning Outcome(s) addressed</b></li> <li>• <b>% of total</b></li> <li>• <b>Assessment due date</b></li> </ul>	Assessment Component	Assessment Description	LO Addressed	% of total	Week due	
		End of semester examination	Written/Multiple Choice Examination	1-9 above	80	20
		Laboratory sessions	Students attend 4 laboratory practicals (2 experiments online/at home, 2 experiments on site in laboratory setting, 3 hours per experiment). Lab reports are assessed.	1-10 above	20	Reports due 1 week after each scheduled in-person experiment, 2 weeks after each scheduled online/at home experiment

#### Reassessment Requirements

#### Contact Hours and Indicative Student Workload<sup>2</sup>

Contact hours: 48 hours
Independent Study (preparation for course and review of materials): 40 hours (approximately 30 hours reviewing lecture material and references to textbook, 10 hours answering tutorial questions)
Independent Study (preparation for assessment, incl. completion of assessment): 26 hours (6 hours preparing for labs and completing lab reports, 20 hours preparation for final exam)

#### Recommended Reading List

Main text for the course:

The recommended text for this module is:

Chemistry – The Molecular Nature of Matter and Change, Silberberg and Amateis, 9<sup>th</sup> edition, McGraw-Hill

The material is also covered in: Chemistry, Chang and Overby, 13<sup>th</sup> edition, McGraw-Hill; Chemistry: Molecules, Matter and Change,

<sup>2</sup> [TEP Guidelines on Workload and Assessment](#)

	<p>Atkins and Jones, 4<sup>th</sup> edition, Freeman; Chemistry for Engineering Students, Brown and Holme, 1st edition, Thompson,</p> <p>There is also a more detailed and advanced text by Atkins and Jones: Chemical Principles – the Quest for Insight, Freeman, 2nd edition. This will also cover the material presented in lectures, and may suit students who already have a strong background in Chemistry.</p> <p>Some students who have not done Chemistry at school find that they benefit from access to a text that starts at a more elementary level. Two such texts that JF Engineering students have found valuable in recent years are: Chemistry, R Lewis and W Evans, MacMillan Foundations; Fundamentals of Chemistry, DE Goldberg, McGraw-Hill</p>
<b>Module Pre-requisite</b>	
<b>Module Co-requisite</b>	
<b>Module Website</b>	<a href="http://www.tcd.ie/Engineering/Courses/BAI/JF_Subjects/1E5/">http://www.tcd.ie/Engineering/Courses/BAI/JF_Subjects/1E5/</a>
<b>Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.</b>	School of Chemistry
<b>Module Approval Date</b>	
<b>Approved by</b>	
<b>Academic Start Year</b>	September 26 <sup>th</sup> 2022
<b>Academic Year of Date</b>	2022/2023