

OCES 2002 Marine Chemistry

Spring 2026

3 credits

1. Instructors

Prof. Jiying LI (JL), Course coordinator
Phone: 3469 2934; Email: jiyingli@ust.hk
Office: CYT 2012, Department of Ocean Science

Prof. Alex S.J. WYATT (AW)
Phone: 3469 2824; Email: wyatt@ust.hk
Office: CYT 2010, Department of Ocean Science

2. Teaching Assistants

Mr. Zekun Zhang,
Office CYT 2nd floor, OCES; Email: zzhangkg@connect.ust.hk

Ms. Xiaotian Zhou (XZ),
Office CYT 2nd floor, OCES; Email: xzhoucl@connect.ust.hk

3. Time and Location:

Monday and Wednesday 12:00 PM – 1:20 PM
Room: Rm5404, Lift 17-18

4. Office hours

- 1) Students can contact TA(s) and instructors by (1) posting questions and comments on Canvas Discussions for whole class interactions [preferred method] or
- 2) Sending private questions via emails or as Canvas messages.
- 3) Make an appointment to meet the instructors in person.

5. Course Description

Credits: 3

Pre-requisite: CHEM 1030

Brief description: This course describes the chemistry of the ocean based on distributions and dynamics of elements, atoms and molecules. This ranges from fundamental physical, thermodynamic and kinetic chemistry to interactions of ocean chemistry with biological, geological and physical processes. It encompasses both inorganic and organic chemistry, and includes studies of ocean-atmosphere dynamics and marine sediments.

6. Intended Learning Outcome

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

- Understand the basic physical and chemical properties of water in seawater.
- Understand the sources, distribution, speciation, and cycling of major and trace elements in marine waters including inorganic nutrients, dissolved organic matter, gases, and trace elements in the oceans.
- Understand the physical, chemical and biological processes affecting the variations in the ocean's chemical environment.

7. Assessment and Grading

- Class participation: 20%, including attending classes, taking in-class quizzes, and participating in in-class discussions.
- Problem assignments: 40%;
- Mid-term exam (closed book): 15 %

- Final exam (open book): 25%

Detailed rubrics for each assignment will be provided after the grades are released. Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission.

Students who have further questions about the feedback including marks should consult the instructor within five working days after the feedback is received.

Final Grade Descriptors:

| Grades | Short Description | Elaboration on subject grading description |
|--------|--------------------------|--|
| A | Excellent Performance | Demonstrates a comprehensive grasp of subject matter, expertise in problem-solving, and significant creativity in thinking. |
| B | Good Performance | Shows good knowledge and understanding of the main subject matter, competence in problem-solving, and the ability to analyze and evaluate issues. |
| C | Satisfactory Performance | Possesses adequate knowledge of core subject matter, competence in dealing with familiar problems, and some capacity for analysis and critical thinking. |
| D | Marginal Pass | Has threshold knowledge of core subject matter, potential to achieve key professional skills, and the ability to make basic judgments. Benefits from the course and has the potential to develop in the discipline |
| F | Fail | Demonstrates insufficient understanding of the subject matter and lacks the necessary problem-solving skills. Shows limited ability to think critically or analytically and exhibits minimal effort towards achieving learning goals. Does not meet the threshold requirements for professional practice or development in the discipline. |

8. The course policy on the use of generative AI.

The use of Generative Artificial Intelligence tools (AI) in assignments is permitted with proper acknowledgment. Students are responsible for contents produced by AI tools and required to disclose how AI is used in generating the content, except for using AI to correct grammatical errors and improve the clarity of text they composed.

9. Student Learning Resources:

Primary textbook(s):

- Pilson, M. E. Q (2013) *An Introduction to the Chemistry of the Sea*. Second Edition. Cambridge University Press, New York, 521 p. [P]
Library access: Physical copy reserved in library
- Libes, S.M. (2009) *Introduction to marine biogeochemistry*. Second Edition. Academic Press, Boston, 928 p. [L]
Library access: <https://lbdiscovers.ust.hk/bib/991012845169703412>

Additional textbook(s):

- Emerson, S. and Hedges, J. (2008) *Chemical oceanography and the marine carbon cycle*. Cambridge University Press, Cambridge, 475 p. [E&H]
Library access: <https://lbdiscovers.ust.hk/bib/991012846066003412>
- Fry, B.J. (2006) *Stable isotope ecology*. Springer Verlag, New York, 308 p. [FRY]
Library access: <https://lbdiscovers.ust.hk/bib/991012692305603412>

10. Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to [Academic Integrity | HKUST – Academic Registry](#) for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

11.Course Schedule:

| Wk | Date | Topic | Reference | Instructor | TA |
|----|--------|--|----------------------------|------------|----------|
| 1 | 2 Feb | Introduction to marine chemistry | P Ch.1, L Ch.1 | AW | YP XZ |
| | 4 Feb | The properties of water in seawater | P Ch.2-3, L Ch.2,3,3 | | |
| 2 | 9 Feb | Major elements and mass balance | P Ch.4, L Ch.3.4-4 | | |
| | 11 Feb | Dissolved gases and air-sea exchanges | P Ch.5, L Ch.6 | | |
| 3 | 16 Feb | The carbonate system: calcite, alkalinity and pH | P Ch. 7, L Ch.15, E&H Ch.4 | | |
| | 18 Feb | <i>Holiday</i> | | | |
| 4 | 23 Feb | Nutrients and primary productivity | P Ch.8, L Ch.9-10, L Ch.11 | | |
| | 25 Feb | Dissolved and particulate organic matter cycling | P Ch.11, L Ch.23 | | |
| 5 | 2 Mar | Marine carbon cycling and global change | P Ch.11, L Ch.25 | | |
| | 4 Mar | Chemical perspectives on ocean pollution | P. Ch 14-15, L CH.28 | | |
| 6 | 9 Mar | Stable isotopes as biogeochemical tracers | E&H Ch.5 | | |
| | 11 Mar | Compound specific and radioisotope tracers | P Ch.10, E&H Ch.5 | | |
| 7 | 16 Mar | Isotope ecology- a chemical approach to ecology | FRY | | |
| | 18 Mar | <i>Mid-term Exam</i> | | | |
| 8 | 23 Mar | Ionic interactions and chemical equilibrium | E&J Ch. 3, L Ch 5.5-5.6 | JL | |
| | 25 Mar | Acids and bases in seawater I | L Ch.5.8 | | |
| 9 | 30 Mar | Acids and bases in seawater II | L Ch.5.8 | | |
| | 1 Apr | Metal complexation | L Ch.5.7-5.8 | | |
| 10 | 6 Apr | <i>Midterm Break</i> | | | |
| | 8 Apr | <i>Midterm Break</i> | | | |
| 11 | 13 Apr | Solubility, dissolution and precipitation; | P Ch. 6 | | |
| | 15 Apr | Redox chemistry of seawaters I | L Ch. 7.2, 7.3 | | |
| 12 | 20 Apr | Redox chemistry of seawaters II | L Ch. 7.2, 7.3 | | |
| | 22 Apr | Ocean deoxygenation and anoxic environment | L Ch.12 | | |
| 13 | 27 Apr | Marine phosphorus cycle | P Ch. 8.1 | | |
| | 29 Apr | Marine nitrogen cycle | P Ch. 8.2 P Ch 9, | | |
| 14 | 4 May | Marine silica cycle | P Ch 8.3-8.5, L Ch. 16 | | |
| | 6 May | Trace metals in the ocean | P Ch 8.3-8.5, L. Ch.12, | | |