OCES 2002 Marine Chemistry

1. **Office hours**
   Students can contact Instructors via TA(s) by (1) posting questions and comments on Canvas Discussions for whole class interactions [preferred method] or (2) send private questions via email or as Canvas message.

2. **Course Description**
   Credits: 3
   Pre-requisite: CHEM 1030
   Brief description: This course describes the chemistry of the ocean based on distribution 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.

3. **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.

4. **Assessment Scheme**
   - 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%

5. **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://lbdiscover.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://lbdiscover.ust.hk/bib/991012846066003412
   - Fry, B.J. (2006) *Stable isotope ecology*. Springer Verlag, New York, 308 p. [**FRY**]
     Library access: https://lbdiscover.ust.hk/bib/991012692305603412
   - Hoefs, J. (2018) *Stable Isotope Geochemistry*. Eighth Edition. Springer International Publishing, Switzerland, 437 p. [**HOEFS**]
     Library access: https://lbdiscover.ust.hk/bib/991012694951003412

6. Course Schedule:

Wk	Topic	Reference
1	Course introduction – what is marine chemistry?	P Ch.1, L Ch.1
	The properties of water in seawater	P Ch.2, L Ch.2
2	Salinity, chlorinity, conductivity and density	P Ch.3, L Ch.3.3
	Major elements and mass balance	P Ch.4, L Ch.3.4-4
3	Dissolved gases and air-sea exchanges	P Ch.5, L Ch.6
	The carbonate system: calcite, alkalinity and pH	P Ch. 7
4	Marine carbon cycling and organic matter	P Ch. 11, L Ch. 23,25
	Isotopes as biogeochemical tracers	P Ch. 10, HOEFS Ch.3, FRY
5	Chemical equilibrium and kinetics	L Ch 5.5
	Thermodynamic basics	E&J Ch. 3
6	Ionic interactions	L Ch.5.6
	Acids and bases in seawater	L Ch.5.8
7	Metal complexation	L Ch.5.7-5.8
	Mid-term exam	
8	Solubility, dissolution and precipitation	P Ch. 6
	Ion speciation in seawater	L Ch. 5.8
9	Marine phosphorus cycling	P Ch. 8.1
	Marine nitrogen cycling	P Ch. 8.2
10	***Holiday***	
	Marine silica cycle	P Ch 8.3, L Ch.11
11	Nutrient stoichiometry	P Ch 8.5
	Trace metals and minor elements	P Ch 9, L Ch. 16
12	Electrochemistry basics	L Ch. 7.2
	Redox chemistry of seawaters	L Ch. 7.3
13	Anoxic marine environments	P Ch.12
	Sediments	L Ch.12
14	Geochemical history of the oceans	P. Ch 15
	Review, discussion and Q &A?	
	Final Exam	