WATER CHEMISTRY 11:375:444
APPLICATIONS OF AQUATIC CHEMISTRY 16:375:517
(co-convened with Environmental Geochemistry 01:460:417)

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Text: Water Chemistry, 2nd Edition (Benjamin, 2015)
Pre-Requisites: Calc I 01:640:135 or 01:640:151, *and* Organic Chemistry 01:160:209 or 01:160:307

I. SYLLABUS

Chemical reactions, equilibrium and activities in aquatic systems
Numerical approaches to weak acid equilibria
Graphical approaches to weak acid equilibria
Using Visual Minteq to solve aquatic equilibria problems
Non-ideal effects on aqueous chemical thermodynamics
Equivalence points and alkalinity
Alkalinity and pH in natural waters
Open systems and equilibrium with the gas phase
Effects of biological and geochemical processes on alkalinity
CO_2 hydration kinetics and air-water exchange
Trace metals in natural waters
Speciation of dissolved metals
Metal transport kinetics in cells
Predominance diagrams
Solid dissolution and precipitation
Adsorption and solid surfaces
Redox thermodynamics
Energetics of biological redox reactions
Chemical kinetics
Biogeochemical processes

II. COURSE GOALS

1. acquire the thermodynamic understanding and chemical intuition necessary to qualitatively and quantitatively describe environmental aquatic systems;
2. develop quantitative tools needed to understand and predict the chemical composition of complex aquatic systems.
3. communicate technical information effectively
4. develop an ability for the independent exploration of problems in aquatic chemistry (graduate)

III. INSTRUCTIONAL ACTIVITIES TO ACHIEVE GOALS

Goal 1: Concepts of thermodynamics, acid/base chemistry, carbonate chemistry, aqueous/surface complexation, colloid chemistry, kinetics, redox processes, isotope hydrochemistry, and biogeochemistry will be covered in the lectures. Students will apply these concepts in homework problems and during in-class recitation periods.

Goal 2: Students will learn how to calculate Gibbs free energy, equilibrium constants, pH, dissolved ion concentrations, rate constants, redox potentials, and isotope fractionation factors. Students will use elementary algebra and chemical principals to solve geochemical problems in homework problems and during in-class recitation periods.

Goal 3. Students will present and discuss the solutions to homework problems during in-class problem solving sessions.

Goal 4: Complete an independent project on a problem in aquatic chemistry of the students choosing (graduate)

IV. ASSESSMENT ACTIVITIES

Goal 1: Knowledge of chemical processes in aquatic systems will be assessed in quizzes and exams.

Goal 2: Ability to use mathematical and scientific knowledge to solve geochemical problems assessed in quizzes and exams.

Goal 3: Communication of answers to specific technical questions will be assessed in quizzes and exams.

Goal 4: The ability for independent exploration of problems in aquatic chemistry will be assessed through the completion of an aquatic chemistry report (graduate).