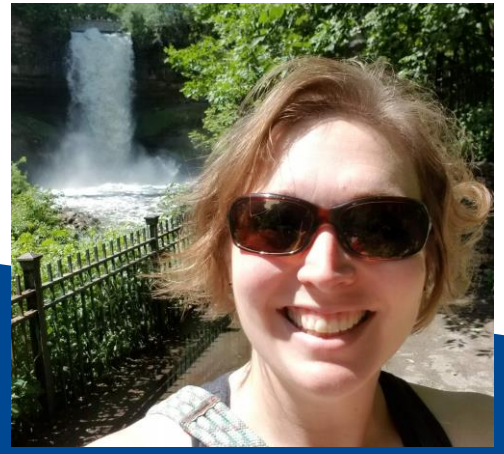
RIVERLAND
Community College

Uniting Chemical Concepts Using Ocean Acidification in a General Chemistry 2 Course



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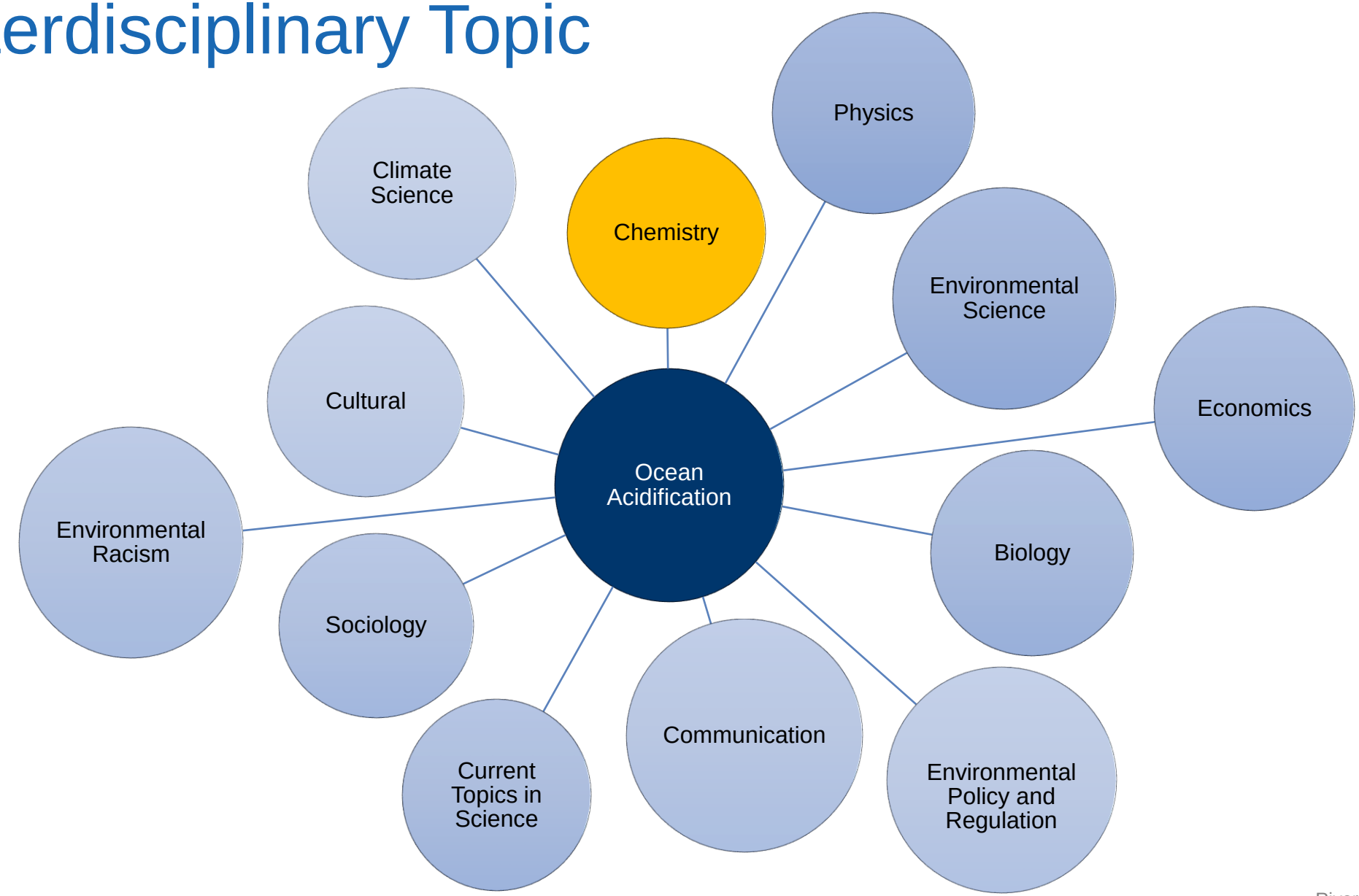
Summary

- How Ocean Acidification (OA) is an ideal research topic to unite general chemistry topics and demonstrate real-world application.
- Discuss the interdisciplinary nature of OA.
- Demonstrate the use of scientific literature and resource review/evaluation.
- Outline use of OA in the classroom.
- Discuss best practices for presenting material to students/options for students to complete their final project.
- Share resources available to incorporate OA into a general chemistry II course.
- Student Feedback
- Additional Resources

Incorporating a Research Topic

- Relating chemical concepts to climate science and environmental chemistry topics.
- Tying together the disjointed nature of Gen Chem II topics.
- Going beyond the textbook with primary literature.
- Illustrate the interdisciplinary nature of science research.

Interdisciplinary Topic



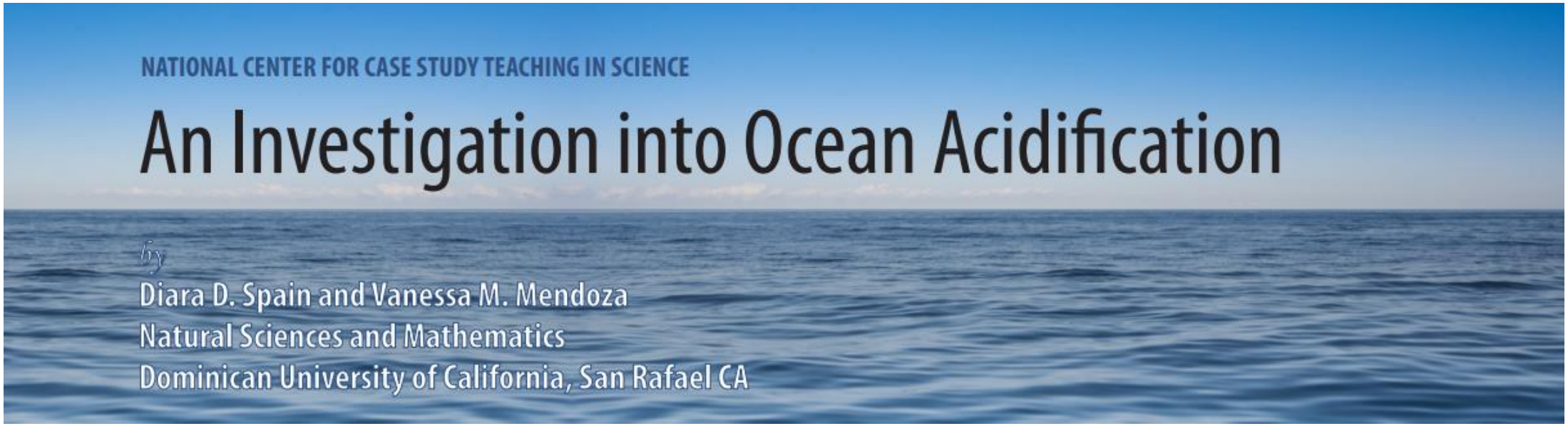
Connecting Chemical Concepts

- The Scientific Method
- Writing balanced chemical equations.
- Redox reactions
- Acid-base reactions
- Greenhouse gases
- Gas Law Stoichiometry
- Thermochemistry
- Reading primary scientific literature
- Evaluating sources for reliability and validity.
- Intermolecular Forces
- Acid-Base Chemistry
- Equilibrium
- Solution Chemistry
- Designing an experiment.
- Graphing and analyzing scientific data.
- Making predictions and drawing conclusions using scientific evidence.

Breaking the Project Down

- Introducing the project
- Literature Research
- Apply class concepts to OA problems
- Design and complete an experiment on OA
- Complete and submit final project

Introducing the Project



- Case study obtained from https://www.nsta.org/ncss-case-study/investigation-ocean-acidification

Sharing Research Literature

- Library Resources and Open-Source Journals

Discussion Board Assignments

- OA Resource Discussion Board
- Peer-Reviewed Science Journal
- Journal Article Refuting OA

Peer-Reviewed Science Journal Article on OA Discussion Board

Includes assessment.

This assignment is designed to help the entire class research and share information they found on ocean acidification for the presentation due at the end of the semester.

Please post in this discussion board one peer-reviewed science journal article you found on OA so the entire class can access it. Peer-reviewed journal articles can be found at the Riverland Library database at https://www.riverland.edu/student-services/library/databases/. This article should have been published within the past 5 years.

Below are the requirements for this assignment:

- Upload a copy of the article for your classmates to access.
- Write a 200 word summary of this article in your own words.
- Provide the proper APA citation for this article.
- Explain why you chose this article using the information we discussed regarding reliable sources from CHEM 1201.

This assignment is worth 25 points. Click the blue link below to view the grading criteria for this assignment.

Peer-Reviewed Science Journal Article on OA Discussion Board Rubric

Please let me know if you have any questions.

Apply Class Concepts to OA problems

- Calculate carbon footprint.
  - Nature Conservancy
  - EPA
  - Carbon Footprint

Carbon Footprint Calculations: An Application of Chemical Principles

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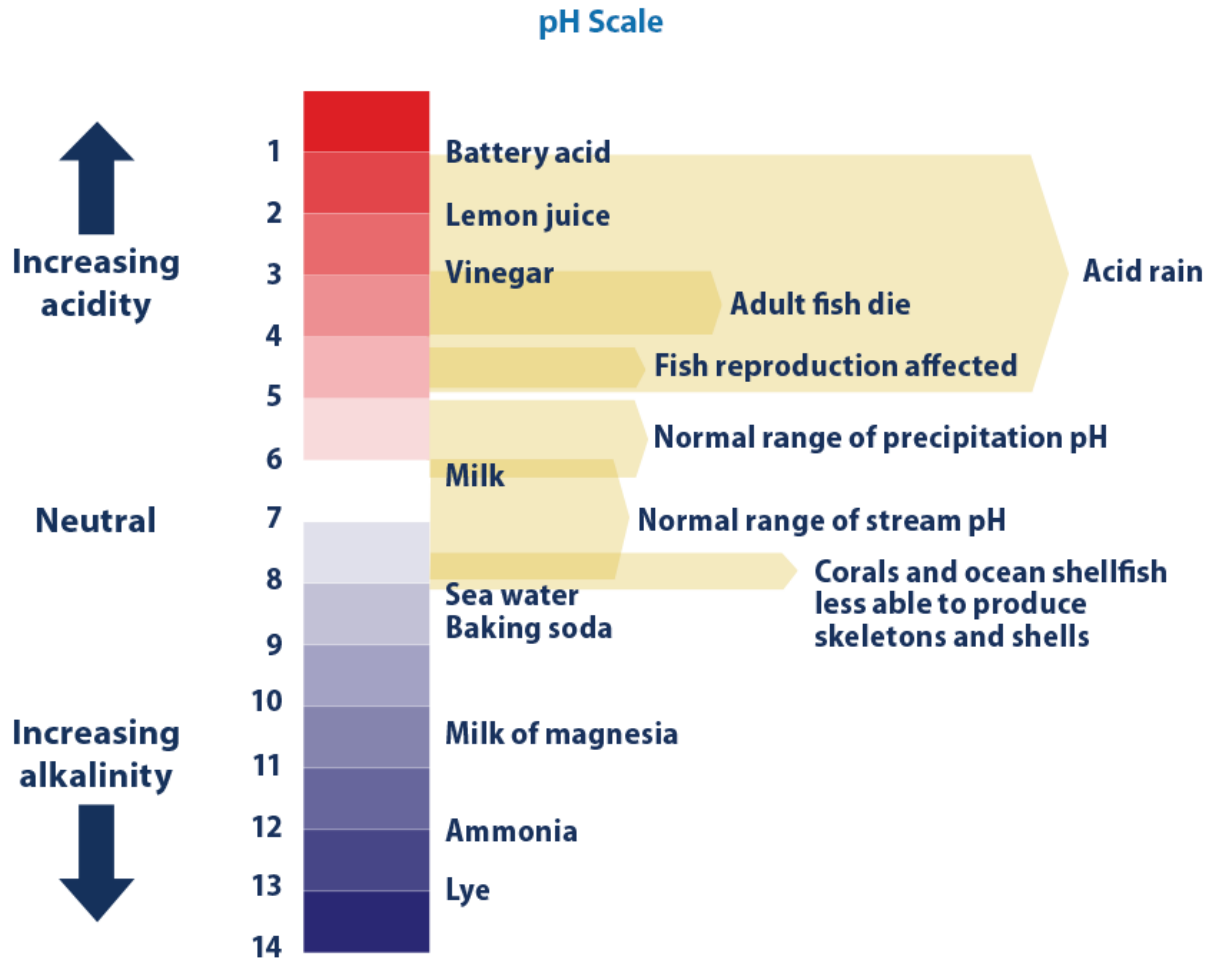
Apply Class Concepts to OA problems - Lecture

- Calculate the pH, pOH, $[H_3O^+]$, and $[OH^-]$ of ocean water.
- Relate changing ocean chemistry to the pH scale for reference.
- Determine the amount of carbon dioxide needed to shift the ocean pH either more basic or acidic.

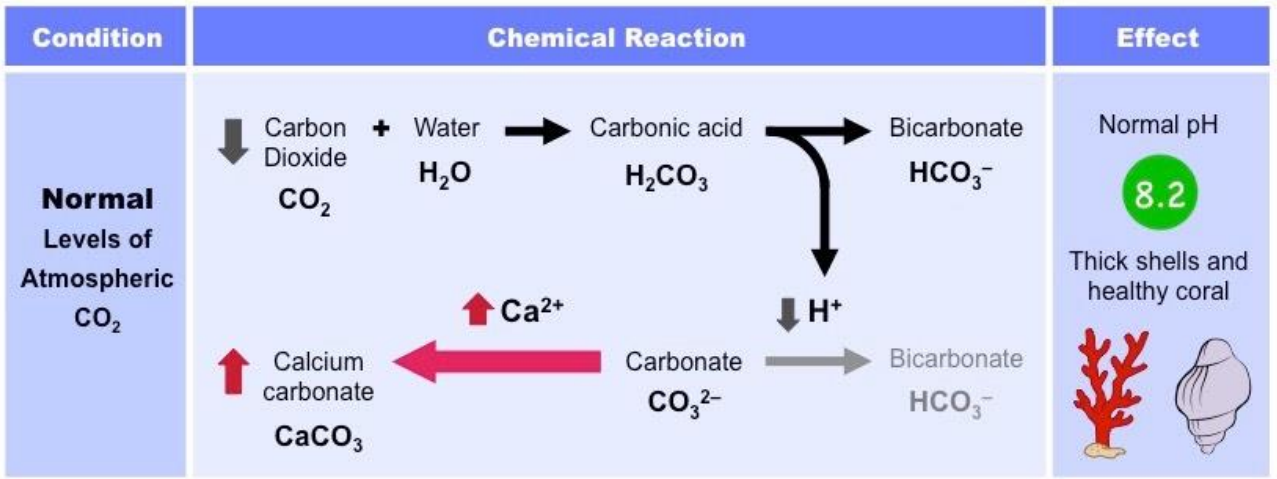


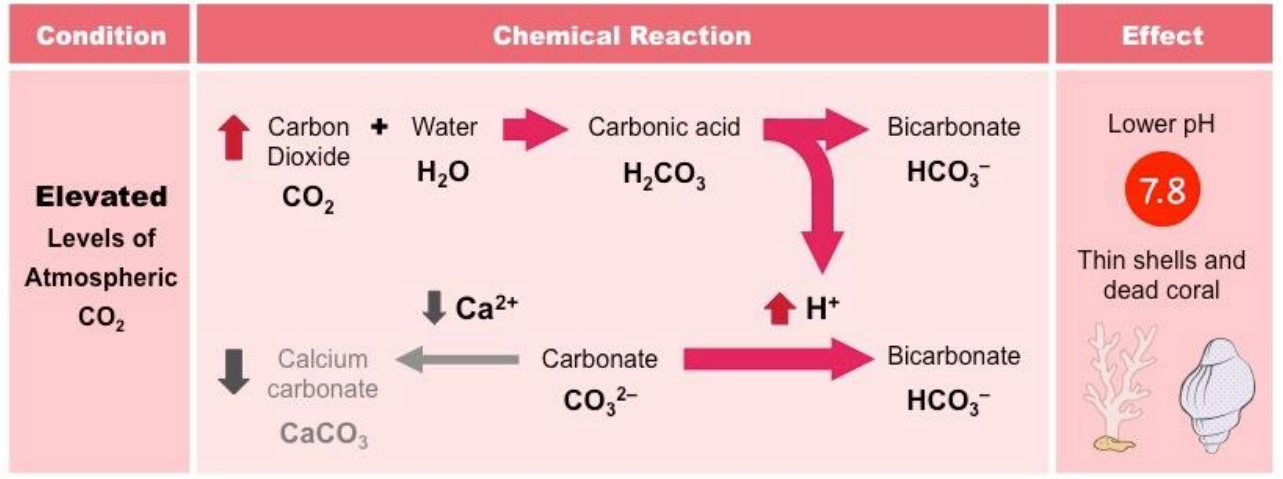
Sources: Recreated from Environment Canada. 2008. The pH scale. Additional data from: IPCC (Intergovernmental Panel on Climate Change). 2014. Climate change 2014: Impacts, adaptation, and vulnerability. Working Group II contribution to the IPCC Fifth Assessment Report. Cambridge, United Kingdom: Cambridge University Press. www.ipcc.ch/report/ar5/wg2.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.

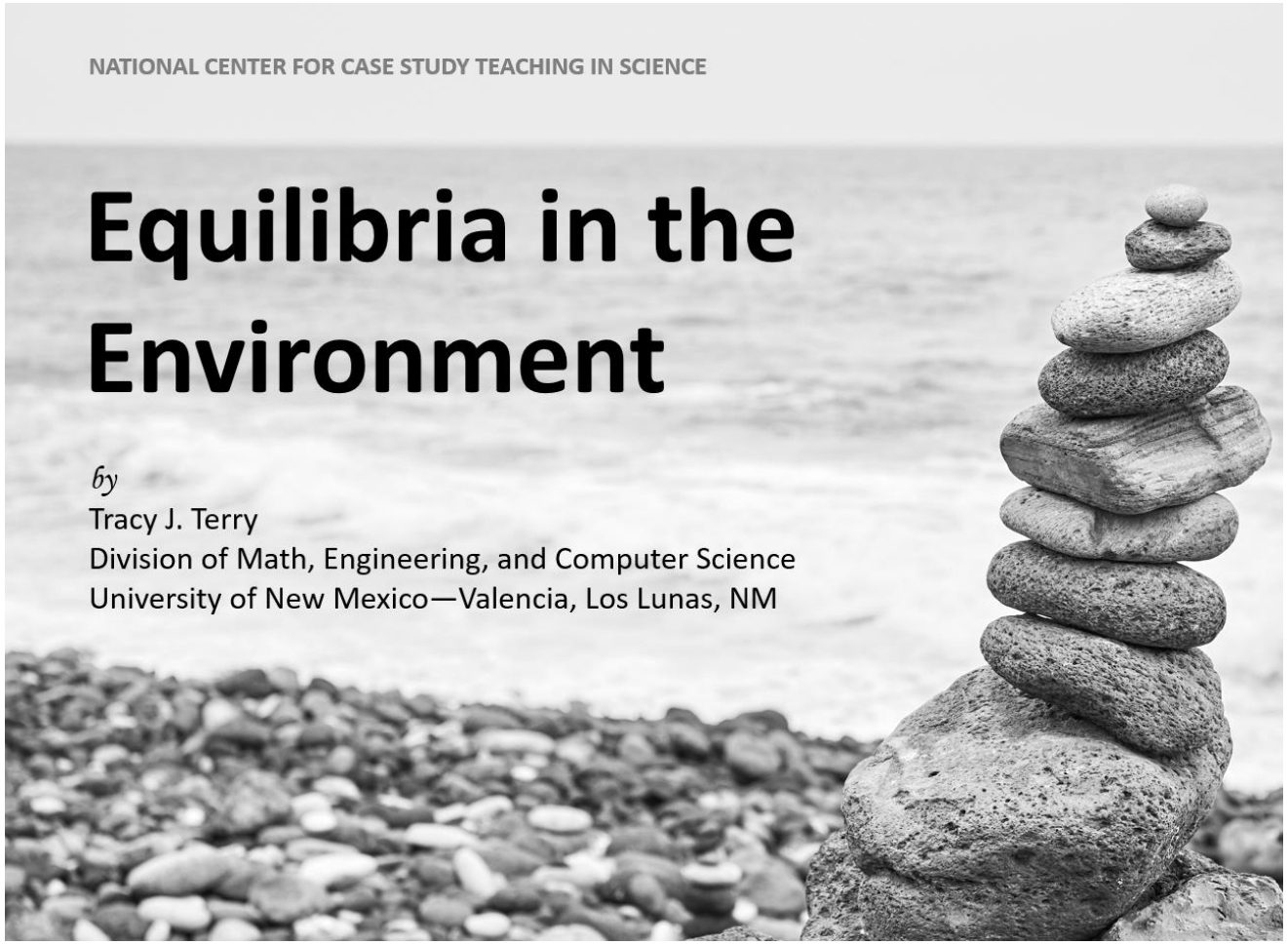
Apply Class Concepts to OA problems - Lecture

- Write chemical questions involved in the ocean acidification of water.
- Solubility of gases in solution.
- Discuss how increasing carbon dioxide levels in the air cause increases absorption into the oceans (le Chatelier's Principle).





Design and Complete an Experiment



- Case study obtained from https://www.nsta.org/ncss-case-study/equilibria-environment

Design and Complete an Experiment

Experimental Purpose

The purpose of the lab is to observe the impact of increasing acidity on limestone over time.

Experiment Outline

Design a lab to test the effect of acidity on limestone. You will need to have five samples, one of which has a neutral pH, the others with decreasing acidity. You will need to decide on the pH of each solution (need to vary each sample by at least a pH of 0.5), calculate how much acid or base to add to each solution to reach that pH, and design and complete the experimental procedure. You will be provided the experimental supplies provided below.

NOTE: You may not need to use all of these supplies. That is ok. You may find you need additional supplies to complete the experiment. If you need additional supplies beyond this list, please talk with your instructor to obtain these supplies.

You will not be given any additional chemicals beyond the ones included in the list below.

Experimental Supplies

Glassware in your drawer	DI water	Sea Shells
4 100-mL volumetric flasks	pH meter	Plastic Pipets
1M Hydrochloric Acid	pH paper	Label Tape
1M Sodium Hydroxide	Digital Balance	Sharpe Marker

NOAA Ocean Acidification Program

- Basic background on OA
- Educational Resources and Webinars
- NOAA Scientific Data
- Publications on OA

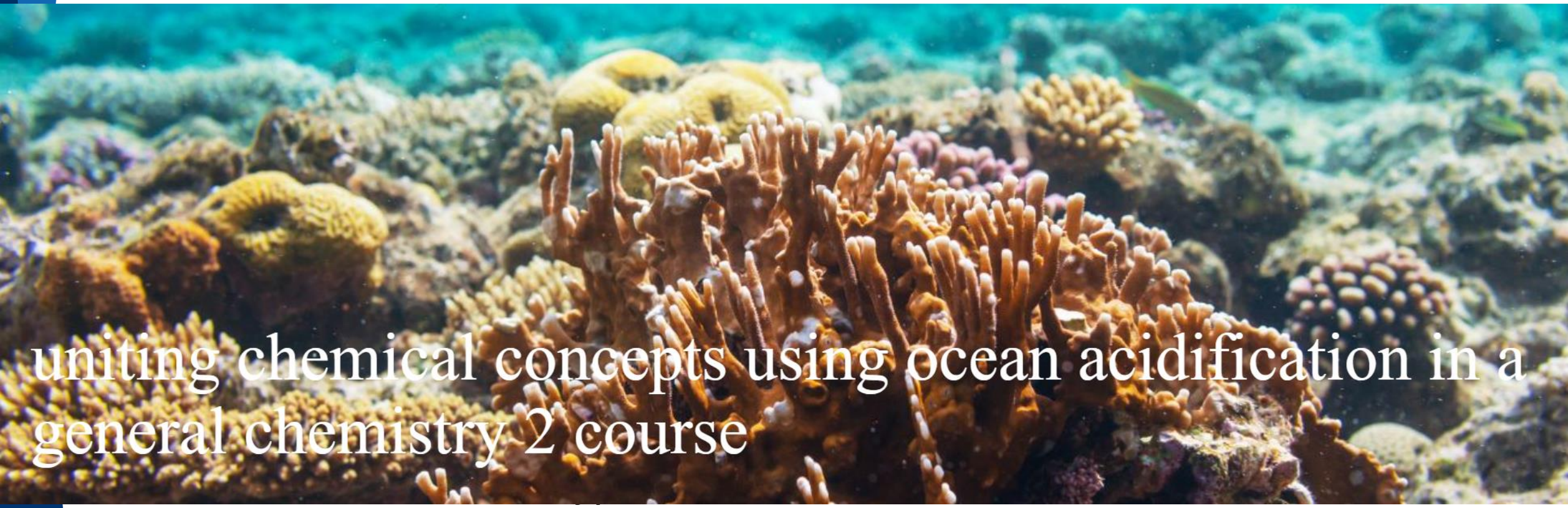
Complete and Submit Final Project

- Students can work alone or with 1 classmate.
- *Part 1: What are the causes, impacts, and chemistry of ocean acidification*
  - This can be a written paper, communicated using a well-prepared PowerPoint, Presi, etc. type presentation, or recorded in a video format.
- *Part 2: Citing and Assessing Sources*
  - Submitted as a MSWord-type document.
  - Need to list sources and explain why they were chosen, if they are reliable, and what type of source it is.

Student Feedback

- The average score of the last class who completed this project was an 85.79%
- Most students (>90%) reported:
  - Project expectations were well organized and easy to understand.
  - Applying chemistry concepts to OA helped them better understand those ideas.
  - the guided-inquiry OA lab helped them better understand the impact of OA on the environment.
  - They felt better equipped to do research and identify reliable sources because of the OA project.
  - Indicated I should continue the study of OA in the course.

Additional Resources



What Are Your Questions?