

Education and Research: Testing Hypotheses

Ocean Acidification: Is there a problem?

Summary

Ocean Acidification is a current topic in the ocean and climate news. Students will utilize a guided WebQuest to research the possible future effects of ocean acidification, explore current models used to predict the changes in the ocean's pH and discuss the current data collection for research.

Key Concepts

- Investigate the development of scientific understanding of ocean acidification.
- Explore current models for predicting pH changes in the ocean and the instruments used to construct them.

Objectives

Students will be able to:

- *Navigate* the internet to *explore* ocean acidification findings in the past and predicted future.
- *Record* their findings from internet sites on ocean acidification.
- *Demonstrate* critical analysis of current (and projected) instruments to measure ocean acidification.
- *Communicate* the ongoing story of ocean acidification with classmates in pairs and through whole class discussions

Materials

- Access to the internet
- "pH data for the World's Oceans" map
- Ocean Acidification WebQuest
- PowerPoint intro
- *Student Reflection Sheet* (including instructor version)
- Universal Indicator (available through Flinn Scientific U0011 http://www.flinnsci.com/store/Scripts/ck_prodList.asp?Index=9873)
- pH paper or pH probes can be used as well
- Drinking straws
- Plastic bags or cups
- Shell fragments
- Plastic bag or cup with vinegar

Procedure

Day 1

- 1. Pass out student reflection sheet.
- 2. Use PowerPoint, SmartBoard, blackboard, overhead or any method that fits your situation, and introduce the first question *What do you know about ocean acidification?*
- 3. Pass out WebQuest Part I (best method is to have an electronic copy for students *or* have already loaded the URL's on the classroom computers to avoid errors). It might be helpful to have the entire class watch the MBARI YouTube video (avoids echoing effect).
- 4. Monitor student completion of the WebQuest. Use teacher discretion as to how you will assign the 13 sections. For example, you might assign sections to different groups of students and then have them present their "findings" to class. You can also have students work in pairs and then stop every 10-15 minutes to have the entire class regroup and share their findings.
- 5. Assign Part II as homework.

Day 2

- 6. Discuss Part II findings and assign Part III and IV (make sure to pass out the *pH data for the World's Oceans* map).
- 7. Have students work in pairs on Part III and IV *or* work through it as a class (if you choose the latter option, it might be a good idea to have the students plot the *pH data for the World's Oceans* map points as homework on Day 1)
- 8. Make sure to bring closure to the discussions on Parts I, II, III and IV

Day 3

- 9. Have students (or student pairs), grab a Ziploc bag with tap water (distilled or even saltwater could be used instead) with universal indicator already inside (around 200ml of water and enough Universal Indicator to make a color change) and a straw. Display procedure in front of class (also display color chart). pH paper and probes may also be used, but they don't have the same visual effect as the indicator.
- 10. Have students blow through straw into water/universal indicator solution until there is a color change. Ask what makes the color change?

SAFETY PRECAUTION: make sure to instruct students to remove their mouth from the straw during inhale (to avoid ingesting the water/indicator mix).

- 11. Hand student groups a baggie or beaker with vinegar. Have them record the pH of the vinegar.
- 12. Drop a shell fragment into both the baggie or beaker with vinegar *and* the baggie or beaker that they just blew in. Have them discuss and/or record what is happening in both baggies/beakers.



- 13. Display the fake facebook page (found on student reflection PPT). Discuss what the entry is prompting.
- 14. After students clean up, have them complete the last three squares of the student reflection sheet, using the back if needed. (Questions are on the instructor version.)

Assessment

- **Performance**—Students will use class time efficiently to stay on task to complete the WebQuest.
- **Performance**—Students will discuss their findings from the WebQuest in a whole-class discussion.
- **Product**—Students will complete the *WebQuest*.
- **Product**—Students will complete the *Student Reflection Sheet*

Additional Resources

- <u>http://www.pmel.noaa.gov/co2/story/Open+Ocean+Moorings</u>
- <u>http://www.pmel.noaa.gov/co2/story/OA+Observations+and+Data</u>
- <u>http://ebbandflow.mbari.org/sections/conditions/MBARI_moorings/oa1_buoy.shtml</u>
- http://data.aoos.org/maps/sensors/
- Kolbert, Elizabeth. "The Acid Sea" *National Geographic*, April 2011 (<u>http://ngm.nationalgeographic.com/2011/04/ocean-acidification/kolbert-text</u>)

Extensions

- Discuss examples of ocean acidification research.
- Have students research an organism that may not be around if the pH of the ocean does drop.
- Missing flyer activity (rubric available) Here Today, Gone in 2061

