Dude, Where'd the Reef Go?

Name ____________________________ Period ____ Date _____

Handout 4 - News Article on Ocean Acidification


Ocean Acidification - The Other CO₂ Problem

The world’s oceans are at risk of becoming too acidic to support coral reefs and certain marine life, and a substantial reduction in CO₂ emissions is urgently needed to stem the dramatic rate of acidification, according to research presented at “The Second International Symposium on the Ocean in a High CO₂ World”, held at the Musée Oceanographique of Monaco from 6 to 9 October 2008. The meeting was co-sponsored by the International Geosphere-Biosphere Programme (IGBP), UNESCO-IOC, the Scientific Committee on Oceanic Research (SCOR), and the International Atomic Energy Agency (IAEA).

“The ocean is sick, and one of its problems is ocean acidification,” said James Orr, chairman of the symposium’s International Scientific Planning Committee.

The ocean has provided an important buffer to higher concentrations of CO₂ in the atmosphere by soaking up 4 kg of the 11 kg of the greenhouse gas produced by the average person every day. But once it mixes with seawater, CO₂ dissolves, making the oceans increasingly acidic. As CO₂ emissions rise, so does the acidity of the ocean. The ocean acidity level has already increased by 30% since the onset of industrialisation, with half of that increase occurring in the last 30 years. The increased acidity is adversely affecting the capability of marine corals and shell-forming organisms to build their skeletal material. It also may be affecting the development lifecycles of marine life, reducing growth, production and life spans. This is bad news for fish stocks, which are already stressed by overfishing and warmer sea temperatures.

Research presented at the symposium underscores the notion that ocean acidification is happening now and is measurable. Evidence supporting this fact includes:

- shell weights of pteropods (small plankton that are food for fish – see picture on the next page) are decreasing [or you could say “some calcifying organisms”, which form the lower end of the food chain];
- calcification rates for coral reefs are decreasing, and will not be able to make up for the erosion of reefs by a more acidic ocean;
- impacts of ocean acidification vary with species;
- ecosystems located near undersea volcanic CO₂ vents—where high CO₂ levels create a more acidic local environment—have experienced a total loss of some species and reduced biodiversity, providing a glimpse of what may happen on a much larger scale if the rate of ocean acidification continues at its current pace;
- controlled laboratory experiments on the effect of ocean acidification on certain calcifiers showed that the organisms could not adapt to a more acidic environment, even after 150 generations;
- ocean acidification could impact underwater sound by increasing noise levels particularly at a shallow depth where marine mammals migrate, which could cause higher stress for them.

A key message from the symposium is that ocean acidity is expected to increase to the point where marine corals and shell forming organisms will actually start to dissolve by the middle of the century. The only way to reduce or slow the trend of ocean acidification is substantial and urgent reductions in CO₂ emissions, according to scientists attending the symposium. Prince Albert II of Monaco, whose environmental foundation provided support for the symposium, attended a special session devoted to raising awareness of ocean acidification amongst policy makers and the general public. He re-affirmed his foundation’s commitment to supporting the scientific community’s research efforts. “Only by working together will we be able to move this important issue forward,” he said.

**Question: Why should scientists continue studying ocean acidification?**

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**Pteropod Limacina helicina**

**Photo: Russ Hopcroft, UAF/NOAA**
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Handout 5 - Blowing Bubbles

Materials:

- 50 mL Water
- Beaker or clear plastic cup
- Drinking straw
- pH indicator solution

Procedure:

Step 1. Pour 50 mL water into beaker

Step 2. Add 15 drops of pH indicator solution to the water in the beaker/cup and mix it with straw

a. Record Color of Solution: ____________________________

b. Record pH: ____________________________

Step 3. Slowly!! Exhale into the water through the straw and record your observations.

c. Record Color of Solution: ____________________________

d. Record pH: ____________________________

Questions:

1. What gas are you exhaling into the solution? ____________________________

2. What is happening to the pH of the solution? ____________________________

Step 4. Add some crushed coral or shells to the solution.

3. What is happening to the pH of the solution? ____________________________
Handout 5 - Blowing Bubbles - Discussion

4. What happened to the crushed coral/shells as the solution color changed?

5. What will happen to ocean pH as we add more CO2 to the atmosphere? Explain why.

6. How might we be able to lower the rate at which ocean acidification occurs?

7. How will marine life be affected by this change in pH? Give two examples.
FCAT Style Assessments

Name ____________________________ Period ____ Date _____

1. You measure the pH of tomato juice, and find it has a pH of 4. This solution is:
   a. A base
   b. An acid
   c. Neutral
   d. None of the above

2. Effects of ocean acidification include:
   a. The melting of polar ice caps
   b. Reduced calcification
   c. Increased UV radiation
   d. Increased water temperature

3. Carbon dioxide from the atmosphere enters the ocean primarily through:
   a. Acid rain over the ocean
   b. Zooplankton
   c. Mixing at the ocean surface
   d. Upwelling

4. The acid resulting from the reaction of carbon dioxide and water which causes ocean acidification is:
   a. Lactic acid
   b. Sulfuric acid
   c. Carbonic acid
   d. Acetic acid
5. Coral reefs are important because:
   a. They provide habitat for many animals
   b. They protect coastlines from wave action and storms
   c. Tourism-based economies depend on them for their revenue
   d. All of the above

6. Which of the following statements about ocean acidification is true?
   a. The pH of the ocean is dropping due to a rise in the level of atmospheric CO₂
   b. The ocean is turning into a vat of acid
   c. Fish are completely unaffected by a drop in pH
   d. Ocean acidification occurs slower at the poles

7. The normal pH range for seawater is:
   a. 8.0-8.3
   b. 7.0-7.3
   c. 6.0-6.3
   d. 9.0-9.3

8. What are two important things people can do to slow the rate of ocean acidification? Why?

   

   

   

9. List two ways in which ocean acidification affects coral reefs.

   

   

   

   

   

   

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