

Name: \_\_\_\_\_  
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Date: \_\_\_\_\_  
Science

## A Sea Change

1) Elizabeth Kolbert said “Whatever you put into the air ends up in the oceans”.  
How does carbon dioxide in the air end up in an ocean?

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2) In talking about ocean acidification, Kolbert claims “We’re really talking about very radical changes. It’s huge. The hugeness...it’s everything. It’s everything about how we live”. How do you think ocean acidification affects how we live?

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3) a. How much carbon dioxide is in the air today? \_\_\_\_\_ parts per million (ppm).  
b. When was the last time we had such a high amount of carbon dioxide in the air? \_\_\_\_\_ years ago.

4)a. What does it mean when Sven reads that pteropods are at the bottom of the food chain?

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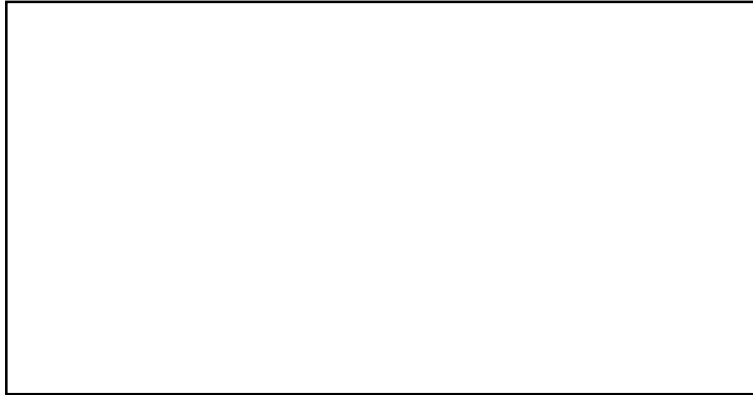
b. Pteropods are about the size of \_\_\_\_\_.

c. How do pteropods swim? \_\_\_\_\_

d. Why do pteropods grow shells? \_\_\_\_\_

e. What is happening to the shells of the pteropods now that the oceans becoming more acidic? \_\_\_\_\_

f. Sketch a pteropod in the box below.



5) Richard Feely, an oceanographer, says that carbon dioxide is a waste product of the making of fossil fuels (such as coal and oil). What does he mean by waste product? \_\_\_\_\_

6) a. How much carbon dioxide does the ocean absorb each day?

\_\_\_\_\_

b. Richard Feely explains that the oceans have absorbed 118 billion metric tons of carbon dioxide in the past 200 years. What is a metric ton?

\_\_\_\_\_

c. What percentage of the total carbon dioxide absorbed by oceans was absorbed in the past 20 years? \_\_\_\_\_

d. What does Richard Feely mean when he says that the amount of carbon dioxide absorbed by the oceans is growing exponentially?

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7) Dr. Jeff Short (from Alaska) explains that the more acid we put in the ocean, the more likely it is that bad things will happen. What two living things did he mention will disappear?

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8) Dr. Short also mentioned that humans have dealt with many crises in the past (for example nuclear war). Why is ocean acidification a “worse fear” than past crises?

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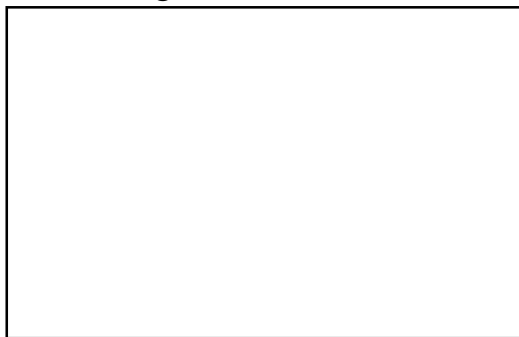
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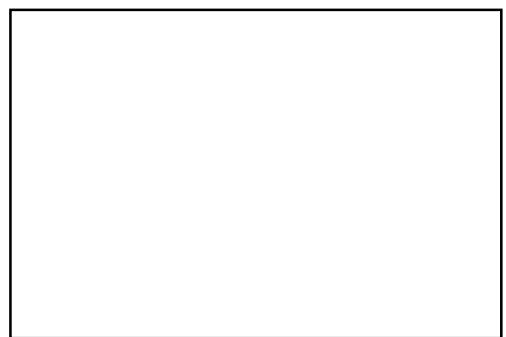
9) a. The pH of a healthy lake is 6.5. What is the pH of pure water that had carbon dioxide added to it?

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b. Deborah Williams placed a tooth in a bottle of pure water for three weeks and a different tooth in a bottle of carbonated water for three weeks. Draw a picture showing what each tooth looked like afterward.



Tooth in  
Pure  
Water



Tooth in Carbonated Water

c. Which of these environments represents what is occurring in oceans today?  
**Circle it** on your picture above.

10) a. Dr. Farvy accidentally put too many pteropods in a covered jar. Since pteropods are animals they inhale (breathe in) oxygen and exhale (breathe out) carbon dioxide, just like us! Soon, there was a build-up of carbon dioxide in the water in the jar, lowering its pH. What happened to the shells of the pteropods as a result?

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b. How long did it take for the build-up of carbon dioxide in the water to affect the pteropods' shells? \_\_\_\_\_

c. Dr. Farvy describes pteropods as "animals living on the edge". What do you think she means by this?

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11) a. When did the earth's oceans contain a similar acidity as what they're heading towards today? \_\_\_\_\_

b. Dr. Caldeira explains that coral reefs and plankton disappeared when the oceans become acidic back then.

- How long did it take for plankton to re-populate the ocean? \_\_\_\_\_
- How long did it take for coral reefs to grow back? \_\_\_\_\_

12) Artist Maya Lin says “What’s below the surface of the water becomes invisible and so we’re not connected to it”. Do you think this has anything to do with how much we pollute the oceans? Explain.

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13) a. Lloyd Peck (a British Scientists doing scientific research in Norway) explains that respiration rate represents the cost of living of a living creature. The harder a creature has to work to survive, the more energy it uses and the more oxygen it takes in. What happens to the respiration rate of a creature when the water becomes more acidic?

b. What does this tell us about how hard creatures have to work to survive when the water becomes more acidic?

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14) When should we begin to worry about how acidic our oceans are becoming? Why?

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- 15) a. What does the Solstrand Hotel use to heat and cool its entire vacation complex? \_\_\_\_\_
- b. Could we use hydropower as a source of energy in the U.S.? Explain your reasoning. \_\_\_\_\_
- c. Why is this method advantageous over our typical methods of heating and cooling our homes?
- \_\_\_\_\_

- 16) a. Sven reads that “Giant wind generators will be placed in the North Sea”. Why are the wind generators being placed in bodies of water instead of on land? \_\_\_\_\_
- b. Wind turbines can produce electricity. Eystein Borgen says “Wind turbines are probably one of the cleanest energy sources there can be”. What makes them so clean? \_\_\_\_\_
- c. Can we use wind power as an energy source in the U.S.? If so, where?
- \_\_\_\_\_

- 17)a. Solar insolation is the amount of sunlight hitting patches of land. What two places in the world have the greatest solar insolation? \_\_\_\_\_
- b. How much money would it cost the U.S. to power the entire country using solar panels? \_\_\_\_\_
- c. Does our government have enough money to do this? Explain your reasoning.
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- \_\_\_\_\_