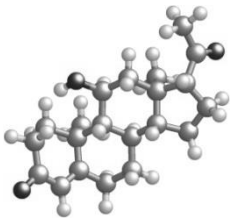
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE



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New Evidence Shows Acid Threat to Marine Life

Ocean acidification caused by climate change is making it harder for creatures such as clams and sea urchins to grow their shells, and the trend is likely to be felt most in the Polar Regions, scientists have said. A thinning of the protective cases of muscles, oysters, lobsters and crabs is likely to disrupt marine food chains by making the creatures more vulnerable to predators, which could in turn reduce human sources of seafood. “The results suggest that increased acidity is affecting the size and weight of shells and skeletons, and the trend is widespread across marine species,” the British Antarctic Survey said in a statement of the findings, which were published in the journal *Global Change Biology*.

Human emissions of greenhouse gases include carbon dioxide from burning fossil fuels. Some of that carbon dioxide ends up in the oceans where it dissolves to form an acidic solution. The acidification makes it harder for creatures to extract calcium carbonate – vital to grow skeletons and shells – especially from cold waters in the Arctic Ocean and around Antarctica, said the study by scientists in Britain, Australia and Singapore. Changes under way in cold waters could be a sign of what to expect in the future in temperate zones and the tropics, said the British Antarctic Survey.

The experts studied four types of creatures – clams, sea snails, lamp shells and sea urchins – at 12 sites, stretching across the globe, from the Arctic to the Antarctic. “The fact the same effect occurs consistently in all four types suggests the effect is widespread across marine species, and that increasing ocean acidification will progressively reduce the availability of calcium carbonate,” it said.

In the past, animals had evolved to be able to live in places where calcium carbonate is relatively difficult to obtain – such as Antarctica – by forming lighter skeletons, the report said. So there was hope that they might be able to evolve again to adapt. “Given enough time and a slow enough rate of change, evolution may again help these animals survive in our acidifying oceans,” said Dr. Sue-Ann Watson, a Research Associate at James Cook University in Australia.

Article by Reuters News Agency. Published on page 6 of *Today*, Tuesday 7th August, 2012.

Questions

1) In general terms, oxides of which type of chemical element dissolve in water to form acidic solutions?

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2) Carbon dioxide is produced as a result of burning fossil fuels.

a) Give some examples of the different types of fossil fuels:

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b) How are fossil fuels formed?

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c) What are fossil fuels used for?

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d) Give the names and formulae of two other gases are released into the Earth's atmosphere when fossil fuels are burnt:

……..

3) Name the chemical reagents that are used and state the observations that are made when testing:

a) For carbon dioxide gas:

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b) For sulfur dioxide gas:

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4) Write the balanced chemical equation, including state symbols, to show how carbon dioxide gas dissolves in water to form carbonic acid (formula, H_2CO_3).

……..

5) Write the balanced chemical equation, including state symbols, to show how sulfur dioxide gas dissolves in water to form sulfurous acid (formula, H_2SO_3)

……..

6) Write the balanced chemical equation, including state symbols, to show how nitrogen dioxide gas dissolves in water to form nitric acid (formula, HNO_3) and nitrogen monoxide.

……..

7) Write an *ionic* equation, including state symbols, to describe how an acid reacts with calcium carbonate (the chemical that the sea creatures shells are made of):

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8) Other scientific reports have stated that the pH of the Earth's oceans have decreased from 8.25 to 8.15 over the last 200 years. Calculate the change in the hydrogen ion concentration in Earth's oceans over the past 200 years.

$$pH = -\log[H^+]$$

$[H^+]$ = hydrogen ion concentration in mol/dm^3

9) Compared to sea creatures living in warmer ocean waters, why is it more difficult for sea creatures living in the Arctic and Antarctic regions to produce thicker shells and denser skeletons?

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10) The Earth's oceans are not the only thing at risk form pollution. Carbon dioxide, sulfur dioxide and nitrogen dioxide dissolve in rain water to form *acid rain*. In what ways is acid rain damaging / harmful to buildings and plants?

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11) What are possible solutions to the problems identified in the article?

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12) In what way(s) does the scientific research outlined in the article follow the *scientific method*?

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- For more information, scan the QR code with an internet enabled smart phone or tablet device.

en.wikipedia.org/wiki/ocean_acidification