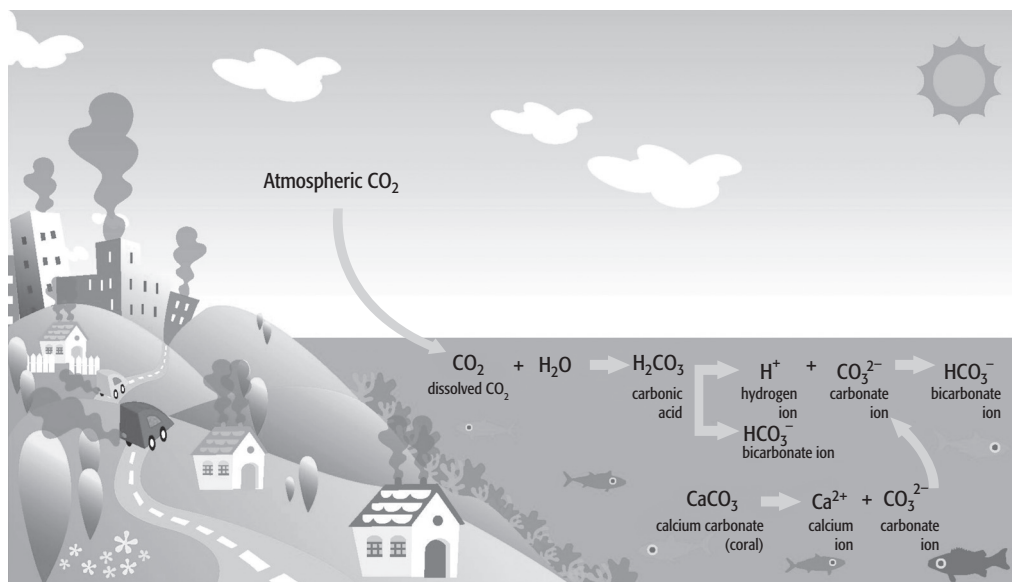


Worksheet 1.10

The acidification of the oceans



The diagram shows how atmospheric carbon dioxide dissolves in the oceans and the products formed. The dissolved CO₂ is of great importance for the balance of life in the oceans, particularly for many organisms, most notably coral, plankton and various types of seaweed.

Use information from the diagram to answer the following questions.

- 1** What are the name and formula for the acid formed when carbon dioxide dissolves in water?

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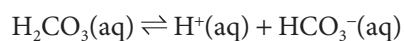
- 2** The diagram refers to the bicarbonate ion, HCO₃⁻. What is the more technically correct name for this ion now?

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- 3** The acid formed when carbon dioxide dissolves in water is only a weak acid. What does the term **weak acid** mean?

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- 4** The ionisation of the acid involves the following reaction:



a What does the symbol \rightleftharpoons mean?

.....

b What does the notation (aq) mean after a formula in an equation?

.....

5 An environmental problem of increasing significance is that of **ocean acidification**. The pH of the ocean surface has already fallen 0.1 units, representing a 30% increase in acidity. By the end of this century, if current emission trends continue, it could fall by another 0.3 units, an almost 100% increase in acidity.

A neutral solution has a pH of 7 and clean seawater has a pH ranging from pH 8 to 8.3. In discussing this, it is important to understand the pH scale: each unit change means a $10 \times$ increase or decrease in acidity so, for example, pH 5 is 10 times more acidic than pH 6 and 100 times more acidic than pH 7.

| Concentrations of hydrogen ions compared to distilled water (pH) | | Examples of solutions and their respective pH |
|--|----|---|
| 10 000 000 | 0 | battery acid |
| 1 000 000 | 1 | hydrochloric acid |
| 100 000 | 2 | lemon juice, vinegar |
| 10 000 | 3 | orange juice, soda |
| 1 000 | 4 | tomato juice |
| 100 | 5 | black coffee, acid rain |
| 10 | 6 | urine, saliva |
| 1 | 7 | 'pure' water |
| 1/10 | 8 | seawater |
| 1/100 | 9 | baking soda, toothpaste |
| 1/1 000 | 10 | milk of magnesia |
| 1/10 000 | 11 | household ammonia |
| 1/100 000 | 12 | soapy water |
| 1/1 000 000 | 13 | bleach, oven cleaner |
| 1/10 000 000 | 14 | liquid drain cleaner |

a Which positive ion does the pH measure the concentration of? Give its name and formula.

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b In neutral distilled water, the concentration of this ion is equal to the concentration of a negative ion that is produced in water. What is the name and formula of this negative ion?

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c Using information given in the table, how many times less acidic is tomato juice than lemon juice?

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