AS and A LEVEL
CHEMISTRY B (SALTERS)

pH and buffers in action

Instructions and answers for teachers

These instructions should accompany the OCR resource 'pH and buffers in action' which supports OCR A Level Chemistry B.

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pH and buffers in action

Calibrating pH meters

Question

The pH of blood

Question

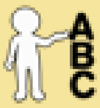
Buffers in soil

Question

OCR

The Activity:

This resource contains a text describing pH and buffer solution applications with questions.



This activity offers an opportunity for English skills development.

This activity offers an opportunity for maths skills development.

Learning outcomes:

This lesson element relates to the specification learning outcomes O(l), O(m).

Associated materials:

'pH and buffers in action' Lesson Element learner activity sheet.

Introduction

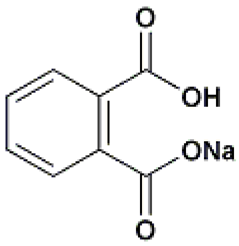
The activity sheet consists of descriptions of five situations where buffers are used or occur naturally. Each description ends with a question for learners to consider.

Learners might work through all five questions independently or in groups. Alternatively, learners or groups could present their findings on one of the questions to the rest of the class. Learners may need to research additional information to complete the questions, providing opportunities to develop chemical literacy and research skills.

Answers to questions

pH Meter Calibration

Sodium hydrogenphthalate contains a weak acid and the sodium salt of that acid all in one molecule.



Calibration buffers containing this chemical have a fixed pH of 4 at 25 °C.

The pH of blood

$[H^+] = K_a \times [acid]/[salt] = 4 \times 10^{-8} \times 0.023/0.024 = 3.83 \times 10^{-8}$ mol dm^{-3}

pH of blood = 7.4

(Blood is at 37 ^{o}C instead of 25 ^{o}C.)

Buffers in soil

If soil becomes too acidic, aluminium cations become soluble. Aluminium ions are toxic to plants, so release of aluminium can badly affect growth of crops.

Buffers in food and drink

$[H^+] = K_a \times [acid]/[salt] = 7.1 \times 10^{-4} \times 0.02/0.01 = 1.42 \text{ x } 10^{-3}$ mol dm^{-3}

pH = 2.85

Some colas can have a pH as low as 2.5.

Dissolving bones

Carbon dioxide can dissolve in water and then ionise to release protons:

$$CO_2(g) \rightleftharpoons CO_2(aq)$$

$$CO_2(aq) + H_2O(l) \rightleftharpoons H^+(aq) + HCO_3^-(aq)$$

$$2H^+(aq) + CaCO_3(s) \rightarrow Ca^{2+}(aq) + H_2CO_3(aq)$$

The pressure at the bottom of the Atlantic Ocean is about 400 kPa. This high pressure means that carbon dioxide is highly soluble. High concentrations of CO_2 shift the second equation to the right, increasing the concentration of H^+ ions. This acid causes the calcium carbonate in bones to dissolve. This also explains why there are no sea shells or coral at this depth.