# pH and buffers in action

## Calibrating pH meters

Before you use a pH meter, you have to calibrate it using a solution of known pH. You want the pH of this solution to remain constant, so you use a buffer solution. The buffer used to calibrate pH meters is a very cunning one: sodium hydrogen phthalate (NaHC8H4O4).

### Question

Usually a buffer solution is a mixture of a weak acid and its sodium salt. Can you work out why this buffer contains only one chemical?

## The pH of blood

Buffers are found in many biological systems. Blood plasma contains carbonic acid (from dissolved carbon dioxide) and sodium hydrogencarbonate. This mixture of a weak acid and a sodium salt buffers the pH of blood. The same chemicals are also part of the waste transport system.

### Question

Use the following data to determine the pH of blood:

 concentration of carbonic acid: 0.023 mol dm–3

 concentration of sodium hydrogencarbonate: 0.024 mol dm–3

 *K*a1 of carbonic acid: 4 × 10–8 mol dm–3

## Buffers in soil

Usually soil contains a buffer made up of carbonic acid and calcium hydrogencarbonate. Usually the carbonic acid is at a higher concentration, making the soil slightly acidic.

The existence of the buffer means the pH does not change much due to acid rain or use of fertilisers.

### Question

If soils do not contain sufficient calcium hydrogencarbonate, soil can become too acidic. Why might this be a problem in aluminosilicate clay soils?

## Buffers in food and drink

Buffers are used to maintain the pH of many foods and drinks. In this context, they are often called ‘acidity regulators’. Common buffer systems in foods are

* benzoic acid and sodium benzoate (which also acts as a preservative)
* citric acid and sodium citrate.

### Question

Use the following data to determine the pH of cola:

 concentration of citric acid: 0.02 mol dm–3

 concentration of hydrogen citrate: 0.01 mol dm–3

 *K*a1 of citric acid 7.1 × 10–4 mol dm–3

## Dissolving bones

The wreck of the Titanic was discovered in 1985, 3800 m deep in the Atlantic Ocean. Since then many artefacts have been brought up from the wreck including clothes, buttons and shoes. But even though over 1500 people died, no skeleton is to be found.

The Mary Rose sank in the shallow seas of the Solent 450 years ago. When the wreck was raised in 1982, over 170 skeletons were found.

Bones contain calcium carbonate and oceans contain dissolved carbon dioxide.

### Question

Can you use equations and Le Chatelier’s principle to explain why no bones were found in the wreck of the Titanic?