BUFFER SOLUTION

Device measuring pH

The meter is limited to measuring the electric potential difference, but it displays the measurements as units of pH rather than volts.

- Note that the pH of buffer solutions is only valid at a temperature of 25°C.
- When measuring the pH of a solution, it is (7) for a neutral solution such as water and less than (7) for acidic solutions and more than (7) for basic solutions.
- The numerical PH value decreases with increasing the acidity of the solution, i.e. increasing the concentration of H^+, and increasing with increasing the base of the solution, i.e. increasing the concentration of OH^-.

pH Meter

Buffer Solution:-

Buffers are compounds mixtures of compounds that, by their in solution, resist changes in pH upon the addition of small quantities acid or alkali.

What do you think will happen if the pH of our blood changes drastically from its normal pH of 7.4?

Obviously, the cells of our body will not function properly and our body systems will fail! Human blood contains a 'buffer' that allows it to maintain its pH at 7.4 to ensure normal functioning of cells. Buffer solutions are also important in chemical and biochemical processes where the control of pH is very important.

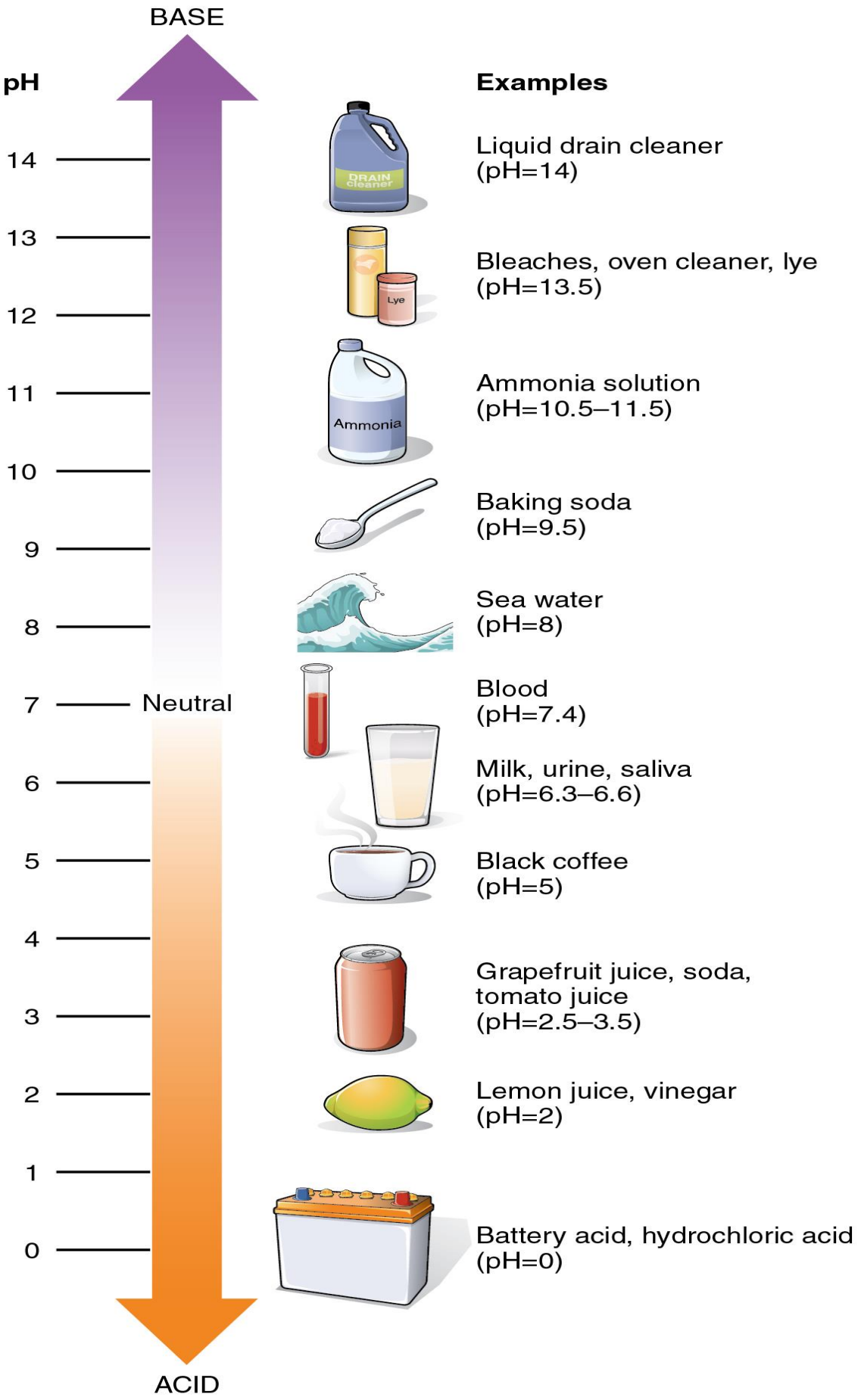
Buffers are solutions that resist a change in pH on dilution or on addition of small amounts of acids or alkali.

Interestingly, a lot of biological and chemical reactions need a constant pH for the reaction to proceed. Buffers are extremely useful in these systems to maintain the pH at a constant value. This does not mean that the pH of buffers does not change. It only means that the change in pH is not as much as it would be with a solution that is not a buffer.

Types of Buffer Solutions

Buffers are broadly divided into two types – acidic and alkaline buffer solutions. Acidic buffers are solutions that have a pH below 7 and contain a weak acid and one of its salts. For example, a mixture of acetic acid and sodium acetate acts as a buffer solution with a pH of about 4.75.

Alkaline buffers, on the other hand, have a pH above 7 and contain a weak base and one of its salts. For example, a mixture of ammonium chloride and ammonium hydroxide acts as a buffer solution with a pH of about 9.25. Buffer solutions help maintain the pH of many different things as shown in the image below.


BASE
pH
Examples
14
13
12
11
10
9
8
7
Neutral
6
5
4
3
2
1
0
ACID
DRAIN cleaner
Lye
Ammonia
Liquid drain cleaner
(pH=14)
Bleaches, oven cleaner, lye
(pH=13.5)
Ammonia solution
(pH=10.5–11.5)
Baking soda
(pH=9.5)
Sea water
(pH=8)
Blood
(pH=7.4)
Milk, urine, saliva
(pH=6.3–6.6)
Black coffee
(pH=5)
Grapefruit juice, soda,
tomato juice
(pH=2.5–3.5)
Lemon juice, vinegar
(pH=2)
Battery acid, hydrochloric acid
(pH=0)

EXPERIMENT NO: 1

DATE:

PREPARATION OF BUFFER

AIM: To prepare the buffer solutions at required pH.

PRINCIPLE:

The pH meter measures at electrical potential developed by pair of electrode pins in a solution. For measurement of pH, an electrode system sensitive to change in H+ ion concentration of solution is taken. The electrode system consists of sequence of electrode whose potential raise with pH (H+ concentration of the solution).

Materials:

1. ACETIC ACID- SODIUM ACETATE BUFFER:

REAGENTS REQUIRED:

Acetic Acid 0.2M: 1.5 ml of glacial acetic acid is made upto 100ml with distilled water.

Sodium Acetate Solution: 0.64 gm of sodium acetate or 2.72gm of sodium acetate trihydrate is dissolved in 100ml Distilled water.

Methods:

Pipette out exactly 36.2ml of sodium acetate solution into 100ml of standard flask and add 14.8ml of glacial acetic acid, make the volume 100ml using distilled water using distilled water. This gives 0.2 M of acetic acid and sodium acetate buffer. The pH is measured with pH meter.

The pH meter is first standararised with pH buffer. Wash electrode with distilled water and introduced into 0.2M acetic acid-sodium acetate buffer prepared, the pH of solution is 4.6.

RESULT:

36.2ml Sodium acetate and 14.8 ml glacial acetic acid were mixed and buffer was prepared. pH was measured initial reading observed was 4 which made upto 4.6 with 5N NaOH.

EXPERIMENT NO: 2

BARBITONE BUFFER:

REAGENTS REQUIRED:

• Diethyl barbituric acid.

• Sodium diethyl barbititrate

Materials and Methods:

Dissolve 2.85gm of diethyl barbituric acid and 14.2gm of sodium diethyl barbititrate in distilled water and upto 1 liter. This gives the barbitone buffer.

The pH meter is first standararised with pH buffer. Wash electrode with distilled water and introduced into barbitone buffer prepared, the pH of solution is 6.8.

EXPERIMENT NO: 3

CITRATE BUFFER:

REAGENT S REQUIRED:

• Citric acid: Dissolve 2.101 gm of citric acid in 100ml distilled water.

• Sodium citrate solution 0.1 M: Dissolved 2.941gm of sodium citrate in 100ml distilled water.

Materials and Methods:

46.5ml of citric acid with 3.5ml of sodium citrate solution and upto 100ml with distilled water. It corresponds to 0.1 M citrate buffer and standardised with pH meter and measures the pH of the prepared solution. This gives citrate buffer at pH 2.5.

RESULT:

Citrate buffer was prepared and the pH observed was 4.8 which was adjusted to 2.5 using 1N HCl and 5N NaOH.

EXPERIMENT NO: 4

CARBONATE- BICARBONATE BUFFER:

REAGENTS REQUIRED:

• Sodium carbonate solution 0.2M: Dissolve 2.12gm of anhydrous sodium carbonate in 100ml Distilled water.

• Sodium bicarbonate solution: Dissolve 1.68gm of sodium bicarbonate in 100ml of distilled water.

Materials and Methods:

Pipette out exactly 27.5ml of sodium carbonate (Na2Co3) solution. To this add 22.5ml of sodium bicarbonate solution and made upto 100ml with distilled water which corresponds to 0.2 M sodium carbonate and bicarbonate buffer.

Standardise pH meter and measure the pH of required buffer. This gives the Carbonate- bicarbonate buffer pH 10.2.

RESULT:

Carbonate bicarbonate buffer was prepared and pH observed was 7.5 which was adjusted to 10.2 using 1N HCl and 5N NaOH.

EXPERIMENT NO: 5

PHOSPHATE BUFFER:

REAGENTS REQUIRED:

• Monobasic: Dissolve 2.78gm of sodium dihydrogen phosphate in 100ml of distilled water.

• Dibasic sodium phosphate (0.2M): Dissolve 5.3gm of disodium hydrogen phosphate or 7.17 gm sodium hydrogen phosphate in 100ml distilled water.

Materials and Methods:

39 ml of dihydrogen sodium phosphate is mixed with 61 ml of disodium hydrogen phosphate This made up to 200ml with distilled water .This gives phosphate (Po4)2 buffer of 0.2M.

Standardized pH meter with standard buffer. Washed electrode with distilled water and introduced it into phosphate buffer prepared. The pH of the solution is 6.8.

RESULT:

Phosphate buffer was prepared and pH was observed 8.5 which was made upto 6.8 using 1N HCl and 5N NaOH.

EXPERIMENT NO: 6

POTASSIUM PHOSPHATE BUFFER:

REAGENTS REQUIRED:

• Dipotassium hydrogen phosphate

• Potassium dihydrogen phosphate

Materials and Methods:

174.18 g/mol dipotassium hydrogen phosphate and 136.09 g/mol potassium dihydrogen phosphate was taken and made up to 200ml using distilled water. This gives the potassium buffer.

Standardised pH meter with standard buffer. Washed electrode with distilled water and introduced it into potassium buffer prepared. The pH of the solution is 6.5.

RESULT:

Dipotassium hydrogen phosphate (K_2HPO_4) and potassium dihydrogen phosphate (KH_2PO_4) solution were prepared and the pH was measured to be 9.87 and 4.23 respectively, the solution were made using 1N HCl and 5N NaOH respectively and the pH was found to be 6.5. View publication.