

Learning Outcomes:

1. To learn about properties of acid and alkali

2. To learn about neutralisation

6.1 Properties of Acid and Alkali

- 1. Acid and alkali are substances that are soluble in water to form solutions. They are commonly found in our food, products and the environment.
- They only show their properties in an aqueous state but not in an anhydrous state.
 Without water, acid cannot ionise to produce hydrogen ions and alkali cannot ionise to produce hydroxide ions.

4 Acid

- 1. Acid is a chemical compound that produces hydrogen ions, H⁺ when dissolved in water.
- 2. Examples of acid:
 - a. Organic acid Acid that contains carbon and is usually found in plants and animals.
 - e.g. Citric acid, acetic acid, ascorbic acid and formic acid
 - b. Inorganic acid It is also known as mineral acid and can be prepared from mineral salts.
 - e.g. Sulphuric acid, nitric acid, hydrochloric acid
- 3. Properties of acid:
 - \approx Tastes sour
 - \approx Corrosive nature
 - \approx pH value is less than 7
 - \approx Reacts with reactive metals
 - \approx Turns moist blue litmus paper to red
 - ≈ Dissolves in water to form an acidic solution

Alkali

- 1. Alkali is a chemical compound that produces hydroxide ions, OH⁻ when it is dissolved in water.
- 2. Examples of alkali: Sodium hydroxide, calcium hydroxide (slaked lime), potassium hydroxide
- 3. Properties of alkali:
 - \approx Tastes bitter and feels soapy
 - \approx Corrosive nature
 - \approx pH value is more than 7
 - \approx Turns moist red litmus paper to blue
 - \approx Dissolves in water to form an alkaline solution

Acidic and alkaline substances

- 1. An acid-base indicator is used to determine the acidity or alkalinity of a substance.
- 2. The commonly used pH indicators in the science laboratories at school are litmus paper, universal indicator, methyl orange, bromothymol blue and phenolphthalein.

Types of indicator	Colour of the solution	
	Acid	Alkali
Litmus indicator	Red	Blue
Methyl orange	Red To	Yellow
Bromothymol blue	Yellow	Dark blue
Phenolphthalein	Colourless	Pink

Table 6.1 Effects of acid and alkaline substances toward various types of indicator

3. The colour of acid-base indicator changes according to the acidity or alkalinity of the substances being tested.

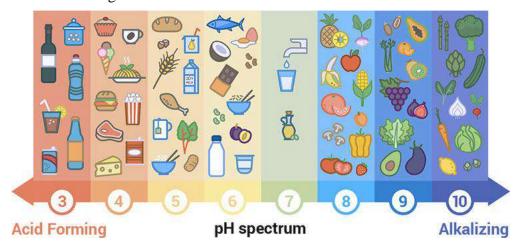


Diagram 6.1 The pH values of various substances

4. The pH indicator gives only an estimation of the pH value. In order to measure the pH value accurately, a pH meter is used. It has a probe to measure the value of a substance.



Diagram 6.2 A pH meter

Strength of acid and alkali

1. The pH scale is a set of numbers from the range of 0 until 14 used to show the strength of an acid or an alkali.

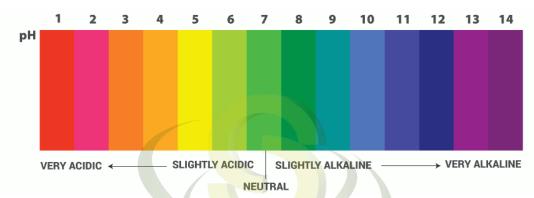


Diagram 6.3 The pH scale

- 2. The smaller the pH value, the stronger the acid.
- 3. The larger the pH value, the stronger the alkali.

Uses of acid and alkali in daily life;

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Acid		
Sulphuric acid	- As an electrolyte in car batteries	
	 To manufacture chemical fertilisers 	
Ascorbic acid	- To produce vitamin C tablets	
	- As a flavour enhancer for food and drinks	
Benzoic acid	- As food preservative	
Hydrochloric acid	- To remove rust from metals before electroplating	
	 As a cleaning agent in toilet detergents 	
Acetic acid	- To make paint and plastic	
	 Used in making pickles and vinegar 	
Carbonic acid, tartaric	- To make fizzy drinks	
acid and phosphoric acid		

Alkali		
Sodium hydroxide	- To make soap, detergent, plastic and rayon (a type of synthetic fibre)	
Calcium hydroxide	To make cement, mortar, glass and slaked limeTo neutralize acidic soil	
Ammonia	 Prevent coagulation of latex To make fertilizer As a cleaning agent in glass cleaning detergents 	
Magnesium hydroxide	- To make antacid medicine and toothpaste	
Potassium hydroxide	- As electrolyte in rechargeable batteries	
Caustic soda	- As a cleaning agent for ovens	

6.2 Neutralisation

1. Neutralisation is a reaction that happens between acid and alkali to produce salt and water. Hence, the salt that is formed is neutral with pH 7.

2. The type of salt produced depends on the type of acid and alkali. For example:

(Acid) (Alkali) (Salt)

- ❖ Hydrochloric acid + Sodium hydroxide → Sodium chloride + water
- ❖ Sulphuric acid + Calcium hydroxide → Calcium sulphate + water
- 3. The complete neutralisation process of an acid or alkali can be done through titration.

Titration

- 1. In this method, an acid is mixed slowly with an alkali until neutralization occurs completely.
- 2. An indicator such as phenolphthalein is used to detect the end-point of neutralisation when the indicator changes colour.

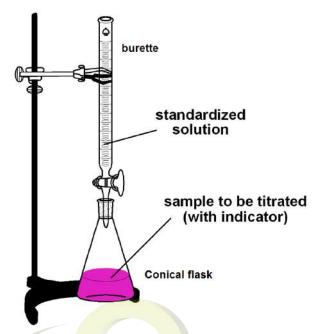


Diagram 6.4 Titration

♣ Neutralisation in daily life

1. Agriculture:

- \approx Acidic soil can be neutralised by slaked lime (calcium hydroxide).
- ≈ Alkaline soil can be neutralised by composts. The decomposition process releases acid gases to neutralise the soil.

2. Industry:

- ≈ The bacteria in latex can be neutralised by ammonia to prevent it from coagulating.
- ≈ Acidic wastes such as sulphur dioxide from the factories are neutralised with calcium carbonate which is alkaline in nature before the wastes are released into atmosphere to prevent air pollution and acid rain.

3. Healthcare:

- \approx The acidic ant bites and bee stings can be neutralised by baking powder to relieve pain.
- ≈ Hair conditioner which is slightly acidic neutralises the residue of shampoo on the hair and makes the hair look smooth, shiny and healthy.
- ≈ Antacid medicine contains weak alkali such as magnesium hydroxide which can neutralise the extra hydrochloric acid in our stomach to relieve gastric pain.
- \approx The acid produced by bacteria in our mouth can be neutralised by toothpaste to prevent dental caries.
- \approx Wasp sting is alkaline and it can be treated with vinegar.