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S2 New Curriculum chemistry

Theme: Acid and Alkalis

Chapter 1 – Acid and Alkalis

Acids

An acid is a substance which, when dissolved in water produces hydrogen ions, H^+ as the only positively charged ions. That is

Examples of nature foods that contain acidic juices



Lemons



Tomatoes



Pineapples



Oranges

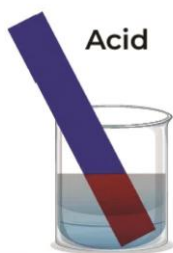
Examples of acids include

Names	Formula	Ions
Sulphuric acid	H_2SO_4	$2H^+$, SO_4
Hydrochloric acid	HCl	H^+ , Cl^-
Nitric acid	HNO_3	H^+ , NO_3
Carbonic acid	H_2CO_3	$2H^+$, CO_3
Ethanoic acid/ acetic acid	CH_3COOH	H^+ , CH_3COO^-

Properties of acids

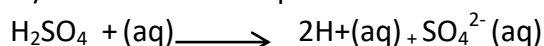
Properties of acidic solutions

- (i) Acids have a **sour taste**, which is why substances like lemon juice and vinegar taste sharp. (But you should never taste solution in a lab unless told to do so)
- (ii) Acid solutions turn blue litmus paper red



Blue litmus paper turns **red**

- (iii) They liberate carbon dioxide from carbonates e.g. potassium and sodium carbonate
- (iv) They liberate carbon dioxide from bicarbonates e.g. potassium and sodium bicarbonates
- (v) They ionize in water to produce H⁺ as the only positive ions examples:



- (vi) **Corrosive action**

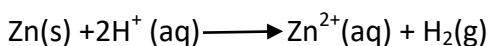
Some acids are corrosive e.g. H₂SO₄. A **corrosive substance** is a material that can cause irreversible damage or destruction to other substances and skin upon contact, often through chemical reactions.



Acid burns - **be careful**

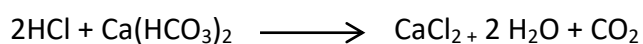
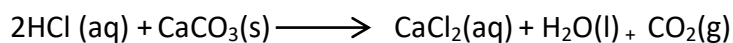
- (vii) **Action with metals**

Some metals react with dilute hydrochloric acid or dilute sulphuric acid to liberate hydrogen gas. Examples of these metals are Zn, Mg, Al.



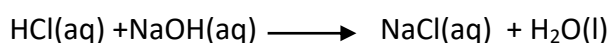
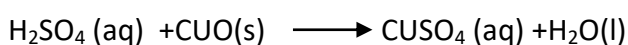
- (viii) **Action with carbonates and hydrogen carbonates**

Almost all acids liberate carbon dioxide from carbonates and hydrogen carbonates.



- (ix) **Reaction with Oxides and hydroxides.**

Acids react with oxides and hydroxides of metals to form salts and water only.



Types of acids

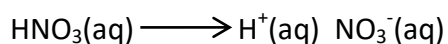
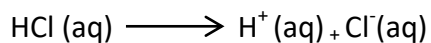
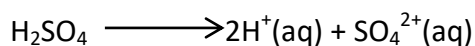
Strong and weak acids

A **strong acid** is one which is completely ionised in water or dilute solution.

Examples of strong acid

Sulphuric acid (H_2SO_4), hydrochloric acid (HCl), nitric acid (HNO_3)

Ionisation is as follows:



Weak acid

A **weak acid** is one which is slightly ionised in water/ dilute solution

That is one which is not fully ionised in dilute solution. Its ionisation is irreversible.

Example of weak acids

Carbonic acid H_2CO_3

Phosphoric acid H_3PO_4

Ethanoic acid CH_3COOH

Methanoic acid HCOOH ,

Sulphurous acid H_2SO_3 etc.

Its ionisation is as follows

Basicity of an acid

Basicity is the number of hydrogen ions in a molecule of an acid.

Monobasic acids have only one ionisable hydrogen ion and are called monobasic acid eg.

Hydrochloric acid (HCl), Nitric acid (HNO) and ethanoic acid (CH₃COOH)

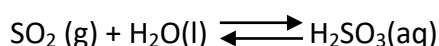
Dibasic acid have two ionisable hydrogen ions e.g. Sulphuric acid (H₂SO₄).

Tribasic acids have three ionisable hydrogen ion e.g. phosphoric acid (H₃PO₄).

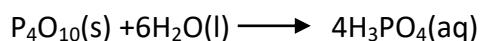
Preparations of acids

By the reaction between an acid anhydride (the acidic oxide of a non-metal) and water, e.g.

Sulphurous acid



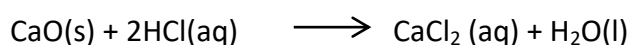
Phosphoric acid



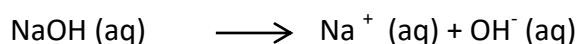
Bases and alkalis

A **base** is a substance that reacts with acids to form water and salt only. A base can be an oxide or hydroxide

Calcium oxide + Hydrochloric acid \longrightarrow Calcium chloride + water



An **alkali** is a compound which, when dissolved in water forms hydroxides ions as the only negatively charged ions for example sodiumhydroxide (NaOH)



Properties of bases and alkalis

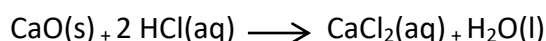
- (a) Bases tend to have a bitter flavor.
- (b) Solutions of bases are like soap, feel slippery when touched.
- (c) They dissolve in water to form solutions that turn red litmus paper blue.



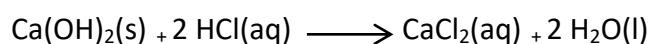
Red litmus paper turns **blue**

- (d) They react with acid to produce salts and water only in a reaction called NEUTRALISATION reaction

Base

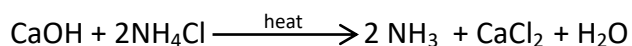


Alkalis



Neutralisation is the combination of the oxide or hydroxide ions of a base with the hydrogen ions of an acid to form water, and a salt.

- (e) They evolve ammonia when warmed with ammonium salts.



Examples of foods with basic juices i.e. Juices with pH greater than 7

- **Bananas** – Naturally alkaline and gentle on digestion.
- **Coconut Water** – Has a slightly alkaline effect and is hydrating.
- **Melons** – Watermelon, cantaloupe, and honeydew are alkaline-forming.

- **Avocados** – Rich in healthy fats and naturally alkaline.
- **Spinach & Kale** – Leafy greens that promote alkalinity.
- **Cucumber** – Refreshing and alkaline-forming.
- **Sweet Potatoes** – A starchy vegetable with alkaline properties.
- **Baking powder**

Uses of neutralizing reaction

- Lime is used neutralize acidic soils in agriculture
- Antacids are used to treat acidic stomach ulcers
- Bee stings are acidic and can be soothed by basic household substances such as baking powder

Acid – base indicators are substances that show different colours in acids and alkalis.

Examples of Indicator

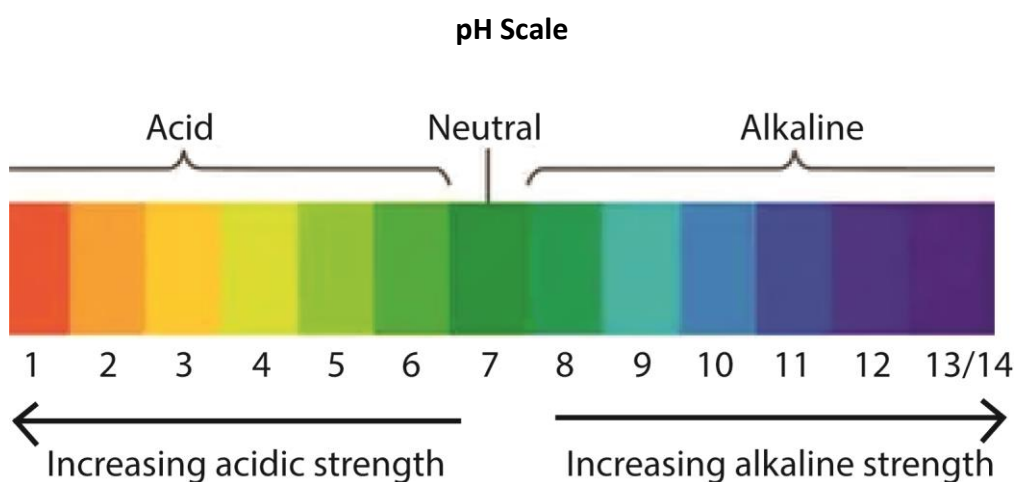
Indicator	Acids	Alkalis
Litmus	Red	blue
Methyl orange	Red	Yellow
Phenolphthalein	Colourless	Red

pH

pH is the measure of the degree of acidity of a solution.

The pH scale

The pH scale is one way of measuring acidity or alkalinity in dilute solution. The PH scale is made of values that run from 1 -14. The acid range is from 1-6 while alkalis (bases) range from 8-14. At PH 7, the solution is neutral that is neither acid nor alkaline.



Revision questions

1. (a) Give two properties of acids
- (b) Define the term base and give one example.
- (c) Define the term alkali and give an example.

2. (a) What is pH
- (b) State the pH range
- (c) Name one property of substance with pH less than 7.
- (b) Give an example of substance with pH = 7

3. (a) What is neutralization?
- (b) Write any word equation for a neutralization reaction.

4. Sulphuric acid is a strong acid while ethanoic acid is a weak acid
- (a) What is a strong and weak acids.
- (b) Two other examples of strong acids.

5. Litmus is a dye made from plant called lichen.

It is red in acid

It s blue in alkalis

It is purple in neutral solution

- (a) What is the scientific term for a substance that changes colour in this way?
- (b) What colour is litmus in a solution of pH 10?
- (c) What colour is litmus in a solution of pH 4?
- (d) What colour is litmus in pure water.

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Thanks

Dr. Bbosa Science