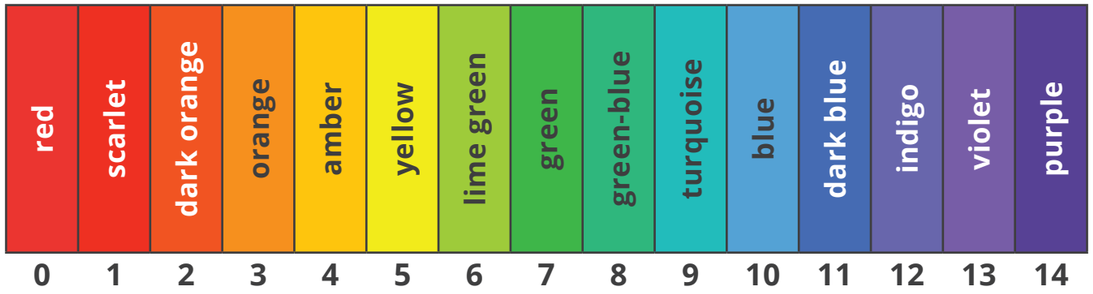
Acids and Alkalis **Knowledge Organiser**

Key Words

acid	A substance with a pH value lower than 7. The closer to pH 0, the more acidic a substance is.
alkali	A soluble base with a pH value higher than 7. The closer to pH 14, the more alkaline a substance is.
base	A substance that reacts with an acid to neutralise it.
chemical reaction	A process that involves the rearrangement of atoms to produce new substances.
indicator	A substance that changes colour when added to acidic or alkaline solutions.
litmus paper	A type of indicator paper used to test pH. Red paper turns blue in alkaline solutions and blue paper turns red in acidic solutions. It is bleached white in the presence of chlorine.
neutral	A substance with a pH value of 7.
neutralisation reaction	A reaction between an acid and a base or an acid and an alkali, forming a salt and water.
pH	A measure of the acidity or alkalinity of a substance on a scale of 0 to 14.
pH scale	A scale from 0 to 14 that is used to measure the acidity or alkalinity of a substance.
salt	A compound formed by the neutralisation of an acid by a base.
universal indicator	A mixture of dyes that changes colour gradually over a range of pH, used to test for acids and alkalis.

pH Scale



Substances with a pH between 0 and 6 are **acidic**. Substances closer to pH 0 are more acidic (stronger).

Substances with a pH of 7 are **neutral**.

Substances with a pH between 8 and 14 are **alkaline**. Substances closer to pH 14 are more alkaline (stronger).

Measuring pH

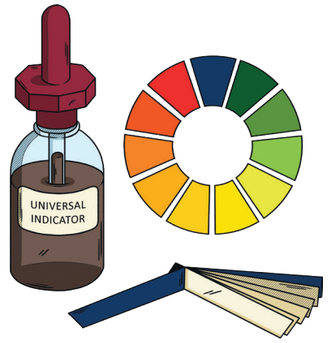
The pH of a substance can be measured in two ways:

- using an indicator
- using a pH meter

Indicators are substances that change colour when added to acidic, alkaline and neutral solutions.

pH meters are pieces of scientific equipment that give the pH as a numerical value.

Some plants contain a substance that changes colour when it is mixed with another substance with a different pH. These plants can be used as indicators.



Indicators

Universal indicator changes colour gradually over a range of pHs.

Red litmus paper stays red in acidic solutions and turns blue in alkaline solutions.

Blue litmus paper stays blue in alkaline solutions and turns red in acidic solutions.

Dangers of Acids and Alkalis

Hazard symbols are recognisable icons that warn about the dangers of a substance.

corrosive

A corrosive substance can react with other substances causing the destruction of materials. It could burn the skin or cause damage to the eyes.

moderate health hazard

This may include irritants. These are substances that may cause redness or blistering if they come into contact with the skin.

The hazards of acids and alkalis depend on the type of acid or alkali, and its concentration.

In **concentrated** solutions, there are more acid or alkali particles in a given volume. To make a concentrated solution, a large volume of the acid or alkali is mixed with a small volume of water. These acids and alkalis are corrosive.

In **dilute** solutions, there are fewer acid or alkali particles in a given volume. To make a dilute solution, a small volume of the acid or alkali is mixed with a large volume of water. These acids and alkalis are often irritants (moderate health hazards).

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Neutralisation Reactions

A neutralisation reaction is a reaction between an acid and a base or an acid and an alkali, forming a salt and water.

acid + base → salt + water

As the acid and alkali are mixed, the pH gets closer to 7. A neutral solution is made if the correct amount of acid and alkali are added together.

The salt that is produced is dependent on the acid and the base that reacts.

Naming Salts

The first part of the name of the salt comes from the name of the metal in the base taking part in the reaction.

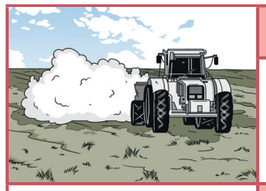
The second part of the name of the salt comes from the name of the acid taking part in the reaction.

Hydrochloric acid produces a **chloride** salt.

Nitric acid produces a **nitrate** salt.

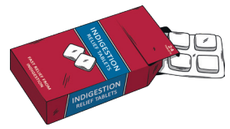
Sulfuric acid produces a **sulfate** salt.

Uses of Neutralisation



Acidic Soil and Lakes

Acid rain may absorb into soil or fall in lakes and areas of open water, lowering their pH. This can affect the survival of plants and animals living and growing in these areas. Slaked lime (calcium hydroxide) can be added to acidic soil and water to increase its pH.



Indigestion Tablets

Heartburn and acid reflux occur when stomach acid (hydrochloric acid) irritates the stomach lining or travels up towards the throat, causing a burning feeling. Indigestion tablets containing bases such as magnesium hydroxide and magnesium carbonate can be taken to treat these symptoms. The bases react with the acid in the stomach, neutralising it to form a salt and water.

Toothpaste

An acidic environment in the mouth, caused by the consumption of some food and drink, can lead to tooth enamel becoming weakened and eroded. Toothpaste contains alkalis such as sodium hydrogen carbonate (sodium bicarbonate), which can neutralise the acid, preventing tooth decay from occurring.

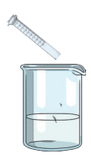
Treating Stings

Bee stings are slightly acidic, with a pH value between 4.5 and 5.5. They can be neutralised using baking soda containing sodium hydrogen carbonate, which is alkaline. Wasp stings are slightly alkaline and can be neutralised using vinegar which contains ethanoic acid.

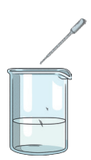
Making Salts

Salts can be produced in the lab using the following method:

1. Use a measuring cylinder to measure the alkali into a beaker.



2. Add drops of the acid from a pipette to the alkali and stir.

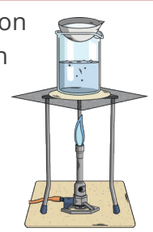


3. Dip a stirring rod into the solution to take a small sample and test the pH by dotting it on a piece of universal indicator paper.

4. Compare the colour of the universal indicator paper with the universal indicator pH scale.

5. Continue to add the acid and test the pH of the solution until a neutral pH result is obtained (pH 7 – green).

6. Heat the neutral solution in an evaporating basin over a water bath until approximately 1/3 of the solution remains.



7. Leave the remaining solution in a warm place to evaporate completely, then observe the remaining crystals.

Analysis and Evaluation

A **mean** is calculated by adding a list of numbers and dividing by how many numbers are in the list.

An **anomalous result** is a result that does not fit the pattern shown by other results. Anomalous results should be identified and omitted from the data before the mean is calculated.

Scientific results are **valid** if the method ensures that the independent variable affects the dependent variable only. All other variables should be controlled.

Results are **repeatable** if the same experimenter repeats the investigation using the same method and equipment and gets the same result.