

pH

Printable revision sheet — Galaxscia

LEVEL 1

What is pH?

pH is a value that tells us whether a solution is **acidic**, **neutral** or **basic**. It is a measuring scale running from **0 to 14**. You can think of it as a "chemical thermometer".

The pH scale

A pH of 7 corresponds to a neutral solution, such as pure water.

A pH below 7 indicates an acidic solution. The closer the value gets to 0, the stronger the acidity.

A pH above 7 indicates a basic (or alkaline) solution. The closer the value gets to 14, the stronger the basicity.

Example :

Lemon juice has a $\text{pH} \approx 2$ (acidic).

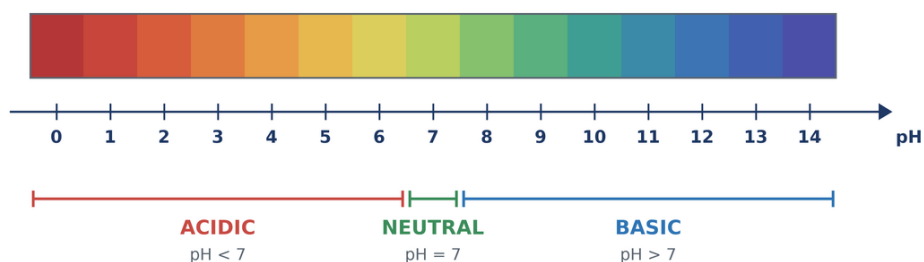
Tap water has a pH close to 7 (neutral).

Soap has a $\text{pH} \approx 9$ (basic).

pH in everyday life

The pH of the water we drink must be close to 7 so that it is neither too acidic nor too basic. Every liquid in our daily life has its own pH: saliva, drinks, household products...

The pH scale



The closer the pH is to 0, the more acidic the solution; the closer it is to 14, the more basic it is.

The limits are written out: the scale stays readable on a black and white photocopy.

Key points — revision questions

Between which values does pH range?

What does a pH of 7 mean?

How can an acidic solution be told apart from a basic one?

What is the ideal pH for drinking water?

LEVEL 2

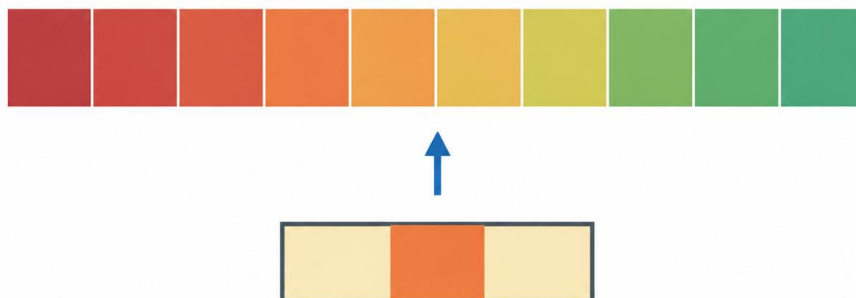
Why measure pH?

Measuring pH is essential to check that a liquid is not too acidic or too basic, and therefore dangerous or corrosive.

Ways of measuring it

There are three main tools for measuring pH:

pH paper



Compare the obtained color with the scale.

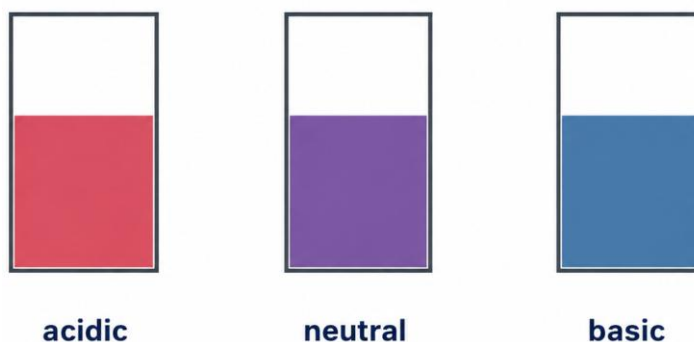
pH paper strips

They change colour depending on the liquid. You simply compare the colour with a reference scale.

Simple and quick

Not very precise

Colored indicator

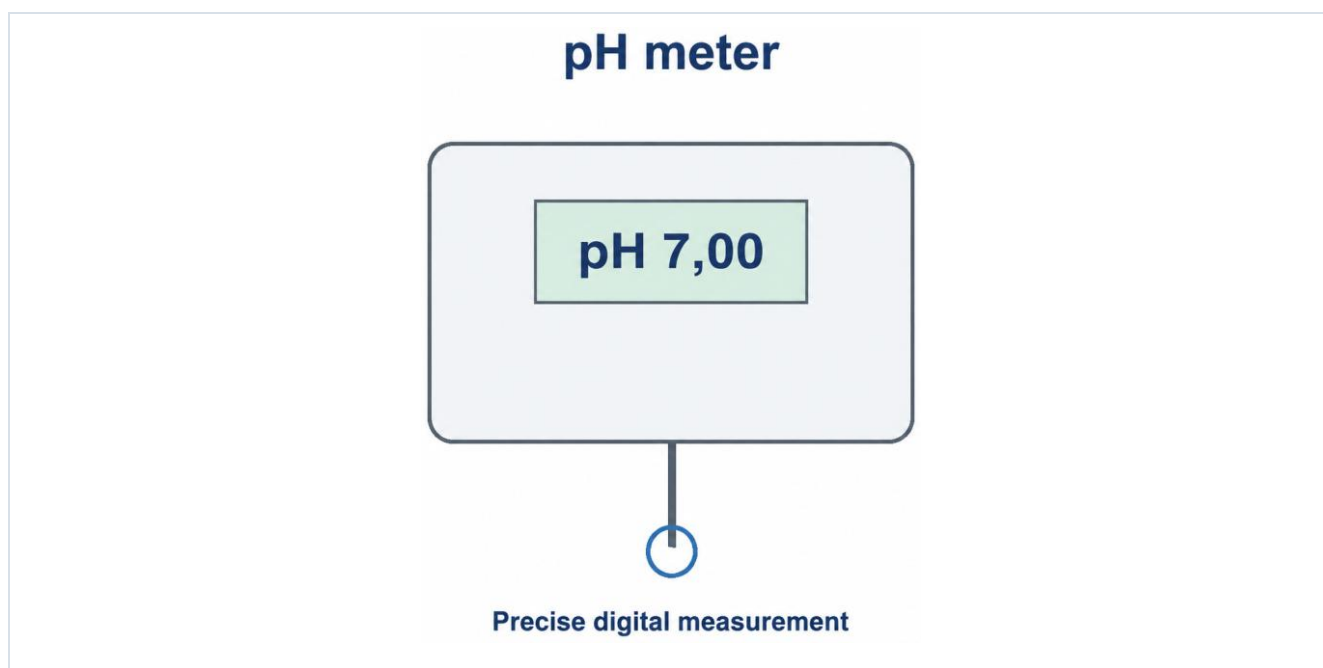


Example: red cabbage juice

Colour indicators

Some substances, such as red cabbage juice, change colour depending on how acidic or basic the solution is.

Visual and good for teaching



pH meter

An electronic instrument that gives the precise pH value using a probe and a digital display.

Precise and reliable

Ideal for the laboratory

Key points — revision questions

Why is it important to measure the pH of a solution?

What are the three main tools for measuring pH?

Which tool gives a quick but not very precise measurement?

Which tool is used in the laboratory for a reliable and precise measurement?

LEVEL 3

The role of ions

pH stands for **potential of hydrogen**. It indicates the concentration of **hydrogen ions H^+** in a solution. These ions, together with **hydroxide ions OH^-** , decide whether a solution is acidic, neutral or basic.

The balance of the ions

At pH = 7: there are as many H^+ ions as OH^- ions → the solution is neutral.

At $\text{pH} < 7$: there are more H^+ ions than OH^- ions $\rightarrow$ the solution is acidic.

At $\text{pH} > 7$: there are more OH^- ions than H^+ ions $\rightarrow$ the solution is basic.

Example :

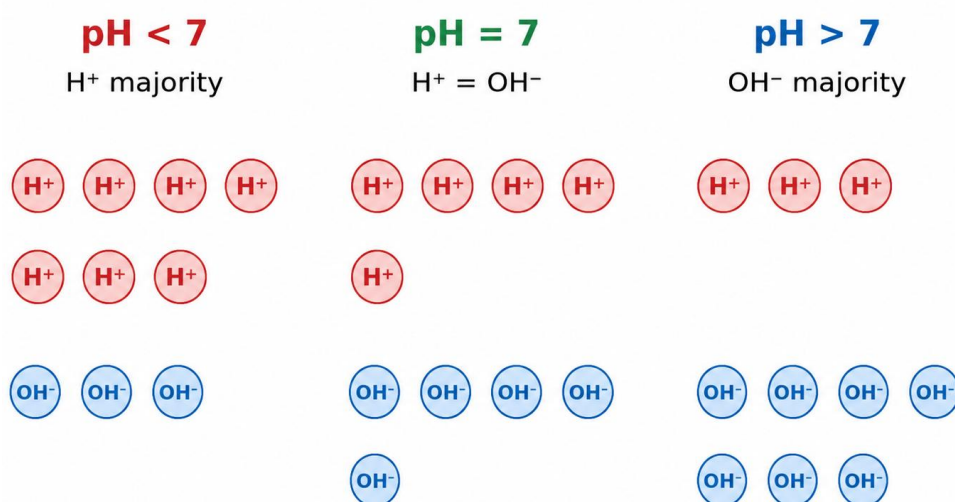
In a lemonade ($\text{pH} \approx 3$), the concentration of H^+ ions is very high.

In a washing solution ($\text{pH} \approx 12$), it is the OH^- ions that dominate.

The relation between H^+ and OH^-

The more H^+ ions a solution contains, the fewer OH^- ions it contains, and the other way round. It is this balance that explains the pH scale from 0 to 14.

pH and ionic balance



Key points — revision questions

What does the abbreviation pH stand for?

Which two types of ion decide the pH?

What happens at the ion level when $\text{pH} = 7$?

How do the proportions of H^+ and OH^- ions change when a solution is acidic? basic?

LEVEL 4

The reactions of acids

Acids are not only solutions with a low pH: they are **reactive** substances that can chemically transform other materials. Let us look at two important types of reaction.

Acid + metal reaction

When certain metals are placed in an acid, a **chemical reaction** takes place:

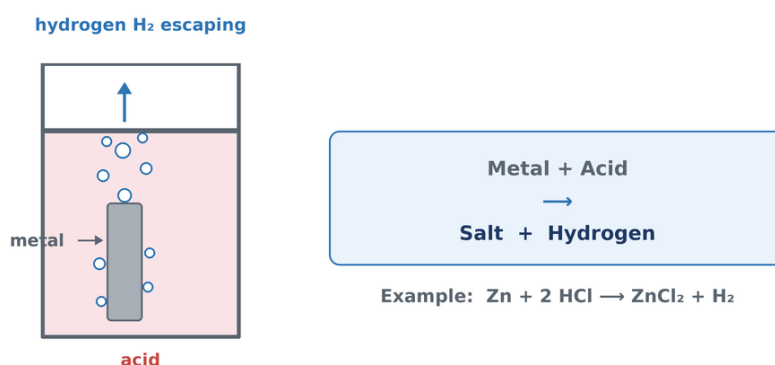
The metal gradually dissolves

Bubbles of gas form on the surface

The solution can heat up

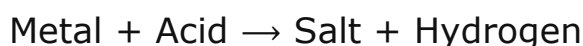
The products of the reaction can then be checked with the appropriate characteristic tests

Reaction between an acid and a metal

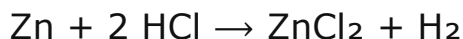
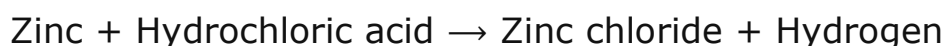


The metal is attacked: a dissolved salt forms and hydrogen is given off.

General equation



Example:



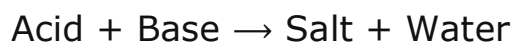
Note that not all metals react with acids, or only slightly: copper, silver, gold, platinum.

On the other hand, some metals such as magnesium react very violently with acids!

Acid + base reaction

When an acidic solution and a basic solution are mixed, the H⁺ ions of the acid react with the OH⁻ ions of the base. Careful: these mixtures often produce **a lot of heat!** You must therefore take care.

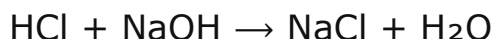
General equation



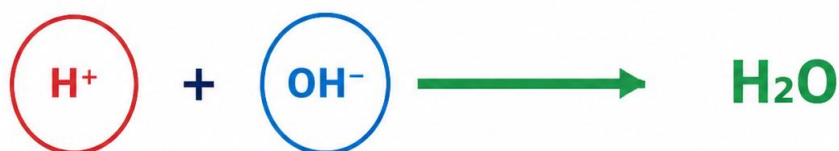
The ions react like this: $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$

Example:

Hydrochloric acid + Sodium hydroxide $\rightarrow$ Sodium chloride + Water



Acid + base reaction



Neutralization: formation of water

How the pH changes

When **a base is poured gradually into an acid**:

The pH rises gradually

When there are as many H^+ ions as OH^- ions, the pH reaches 7: complete neutralisation

If more base is added, the pH goes above 7 and the solution becomes basic

The opposite happens if an acid is added to a base.

Key points — revision questions

What does mixing an acid and a metal produce?

What does mixing an acid and a base cause?

How does the pH change when a base and an acid are mixed?