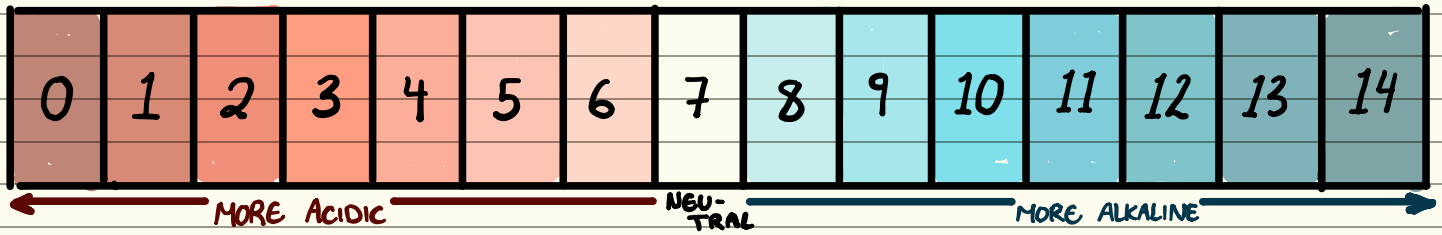
The PH Scale



What is PH?

- It is a measure of how acidic or alkaline a solution is
- It depends on the concentration of hydrogen ions (H^+)
- Ranges from 0 → 14

PH Value	Meaning
< 7	Acidic
= 7	Neutral
> 7	Alkaline (Basic)

Acids and Bases

Acids:
- Release H^+ ions in water
- E.g: HCl, H_2SO_4, CH_3COOH
- They are electron pair donors

Bases /Alkalis:
- Bases accept H^+ ions
- Alkalis release OH^- ions in water
- Eg: $NaOH$, KOH, NH_3

Strong vs Weak:

Strong acid/base : fully ionises in water
Weak acid / base : Partially ionises in water

* A dilute strong acid can have a higher pH than a concentrated weak acid

Pro tips:

- PH measures ion concentration, not how "dangerous" something is.
- The PH scale is logarithmic

PH Calculations & log Scale

PH Formula

$$pH = -\log_{10}[H^+]$$

$[H^+]$ is in $mol\,dm^{-3}$

Logarithmic nature of pH

- Each 1 unit change in pH = 10× change in H^+ concentration

pH change	H^+ change
pH 2 → 3	10× less acidic
pH 3 → 5	100× less acidic

Calculating pH (Examples)

Example 1:

$[H^+] = 1.0 \times 10^{-3}$

$pH = 3$

Example 2:

$[H^+] = 1.0 \times 10^{-7}$

$pH = 7$ (neutral)

pH and pOH

$$pH + pOH = 14$$

- High pH → low pOH
- High OH^- → low H^+

Final pro tip:

- if $[H^+]$ is given, always use -log
- Always include units when writing concentrations

Indicators, Neutralization & Curves

Indicator	Acidic	Neutral	Alkaline
Litmus	Red	Purple	Blue
Phenolphthalein	Colourless	Colourless	Pink
Methyl orange	Red	orange	Yellow
Universal Indicator	Red	Green	Purple

Neutralization Reactions:

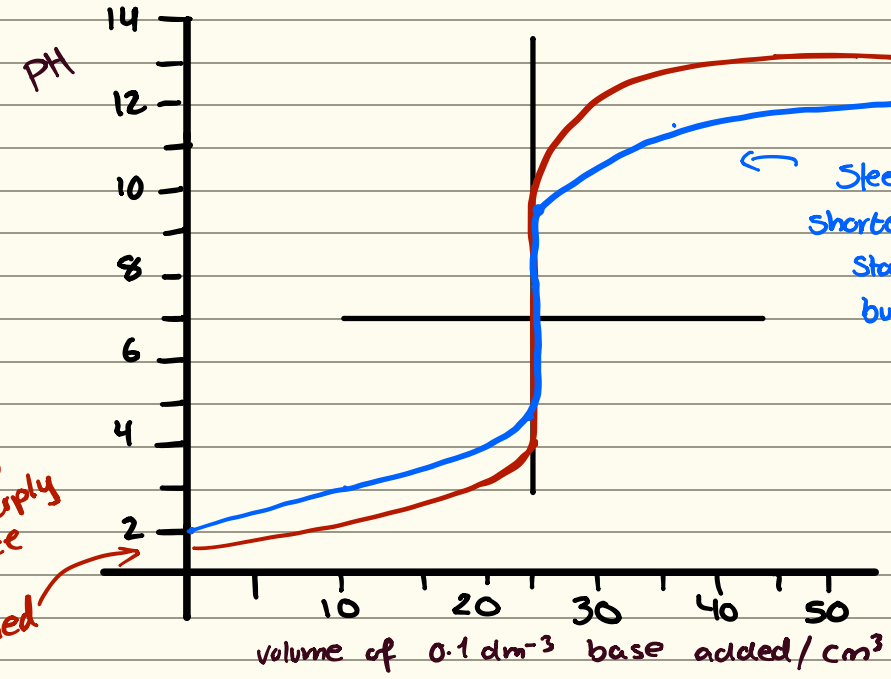
Acid + Base ⟶ Salt + Water

e.g:

$$HCl + NaOH \rightarrow NaCl + H_2O$$

H^+ reacts with $OH^- \rightarrow H_2O$

pH Curves (Titrations)



Steep part of the curve is shorter for low $[H^+]$ as we started at a higher pH but the equivalence point is still pH 7

pH starts low then rises sharply as equivalence point is reached

→ Strong Acid + Strong Base =
- Sharp vertical rise
- Equivalence point at pH 7

→ Weak Acid + Strong Base =
- Gradual curve
- Equivalence point above pH 7

Final Pro tips:
- Neutralization ≠ pH 7 (depends on acid/base strength)
- Buffers: resist changes in pH, They work by removing added H^+ or OH^-
- In titrations, always look for the equivalence point.