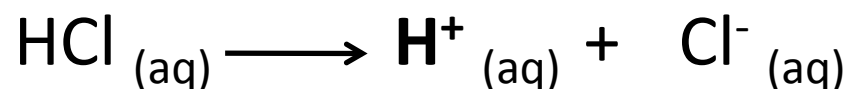


Introduction to
Acids and Bases

Acid

- A substance that produces hydrogen ions, \mathbf{H}^+ _(aq), when it dissolves in water.
- Sour-tasting and good conductors of electricity.

e.g., Hydrochloric acid:



e.g., Sulfuric acid:



Base (Alkali)

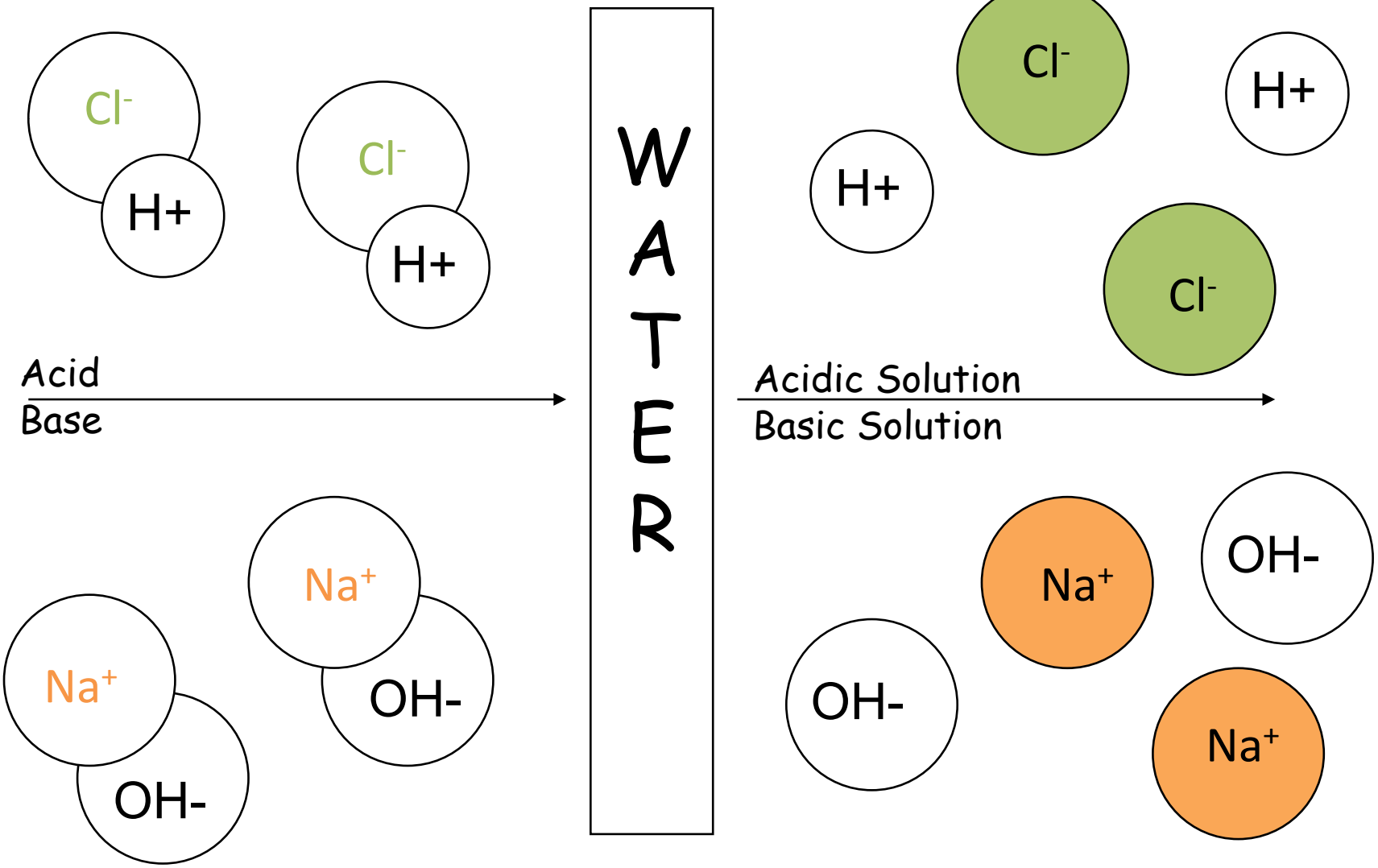
- A substance that produces hydroxide ions, **OH⁻**_(aq), when it dissolves in water.
- Bitter-tasting, slippery-feeling compounds; good conductors of electricity.

e.g., Sodium hydroxide:



e.g., Ammonium hydroxide:





Indicator

- A substance used to distinguish between acidic and basic solutions.
- These compounds change colour in response to changes in the concentration of hydrogen ions or hydroxide ions.
- e.g., Litmus



Red litmus turns blue in basic solutions



Blue litmus turns red in acidic solutions

A **B A S E**
C **L**
I **U**
R E D **E**

Litmus paper is being used in the picture to the right. What type of solution is it?

It is an acid.



Indicators

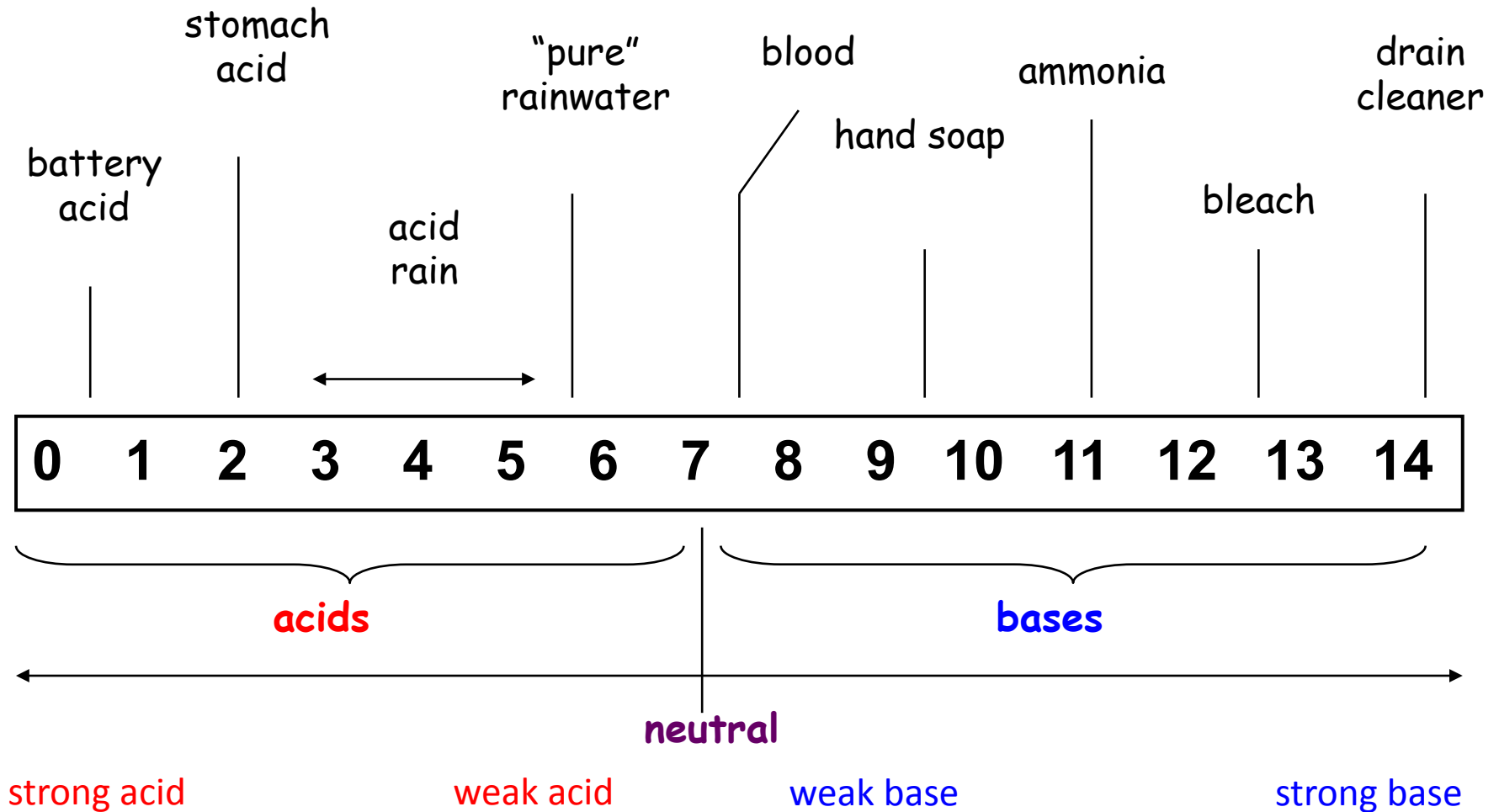
Indicator	Colour in Acid	Colour in Base
Bromothymol blue	Yellow	Blue
Phenolphthalein	Colourless	Pink/Fuchsia
Blueberry Juice	Red/Pink	Green
Red Litmus	Red/Wet	"Blue"
Blue Litmus	"Red"	Blue/Wet
Methyl Orange	Orange-Red	Yellow

The pH Scale

- A scale to measure the relative acidity or basicity (alkalinity) of a solution.
- The pH of a solution can range between 0 and 14.
 - pH of 7 is Neutral
 - Acidic solution: $\text{pH} < 7$ (more hydrogen ions than hydroxide ions)
 - Basic solution: $\text{pH} > 7$ (more hydroxide ions than hydrogen ions)

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

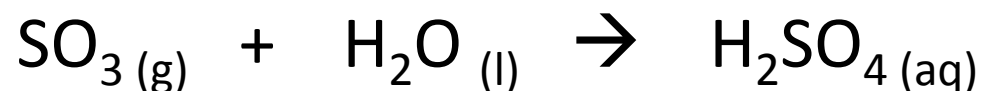
Values on the pH scale go up in powers of 10; therefore, the pH of 1 is 10x more acidic than the pH of 2.



Making an Acid

- React a **non-metal oxide** with water

e.g., sulfur trioxide + water → sulfuric acid

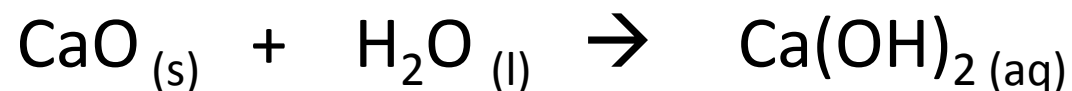


Did you know: this occurs in our atmosphere as the result of industrial smoke emissions and produces acid rain?!

Making a Base

- React a **metal oxide** with water

e.g., calcium oxide + water \rightarrow calcium hydroxide

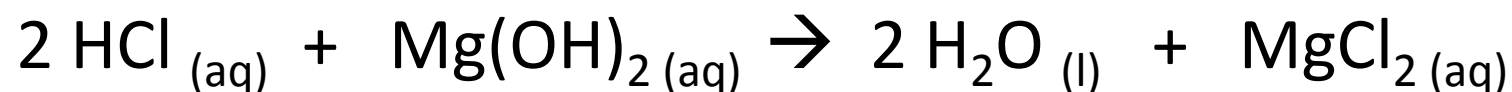


Did you know: calcium hydroxide is also called “lime” and can be used to neutralize the effects of acid rain in lakes?! (The problem is, it’s not practical as it is costly and time-consuming).

Neutralization

- Acids and bases react together to form **water**, which is **neutral**.
- The other product of neutralization is a **salt** (an ionic compound) that forms from the remaining elements.

e.g., hydrochloric acid + magnesium hydroxide:



acid

base

water

salt

- A neutralization reaction is a special kind of double displacement reaction.

