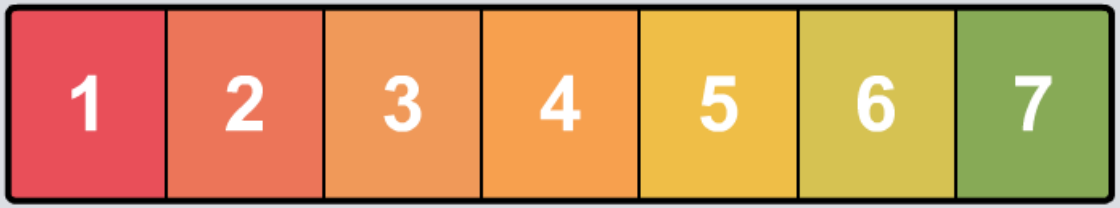
Properties of Acids and Alkalis



Strong acids

Acids can be **strong** or **weak**.

Strong acids **dissociate** fully into solution, so that all their H^+ ions are released into the mixture.

$$HA \rightarrow H^+ + A^-$$

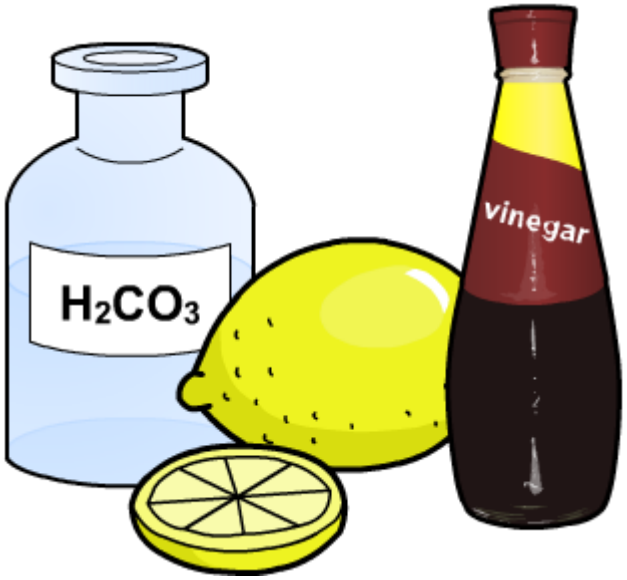
Hydrochloric acid is a typical strong acid, so the dissociation reaction is complete:

$$HCl \rightarrow H^+ + Cl^-$$

Weak acids

Weak acids do not dissociate fully; some of their H^+ ions stay attached to the acid molecule.

The dissociation of a weak acid in water is a reversible reaction:



$$HA \rightleftharpoons H^+ + A^-$$

Ethanoic acid is a typical weak acid, with its ions in **dynamic equilibrium** with the un-dissociated acid. The reaction is moving in both directions at the same rate.

$$CH_3COOH \rightleftharpoons H^+ + CH_3COO^-$$

Strong or weak?

Sulfuric acid

Sulfuric acid (H_2SO_4) contains two hydrogen ions per sulfate ion. Both hydrogen ions can dissociate in solution.

It is therefore called a **diprotic** acid. In general the first H^+ ion of a diprotic acid will dissociate more readily than the second.

H_2SO_4 is a strong acid, so it fully dissociates to release its first H^+ ion:

$$H_2SO_4 \longrightarrow H^+ + HSO_4^-$$

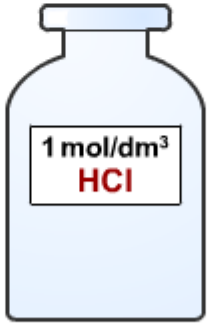
However, HSO_4^- is a weak acid, so it only dissociates partially to release the second H^+ ion:

$$HSO_4^- \rightleftharpoons H^+ + SO_4^{2-}$$

Identifying strong and weak acids

How is the behaviour of strong and weak acids different?

Click the buttons to find out by testing the acids in different ways.



litmus paper

pH paper

electricity

magnesium

summary

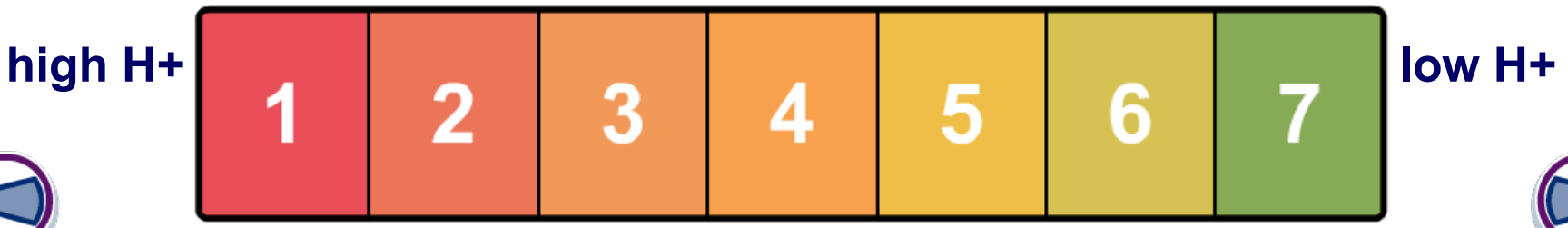
pH of strong and weak acids

pH is a measure of the number of H^+ ions in solution, with a lower pH meaning more H^+ ions.

Because strong acids dissociate fully in solution, they contain more H^+ ions per molecule of acid, producing a lower pH.

Compared to weak acids of the same concentration, strong acids:

- have lower pH values
- are better conductors of electricity
- react more quickly.

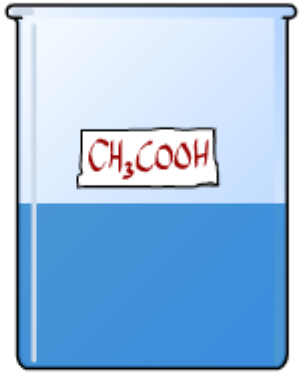


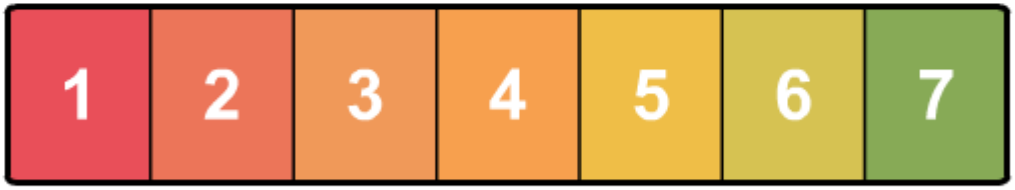
pH or concentration?

Diluting acids

The pH of an acid is not only a measure of strength but also concentration. The concentration of H^+ ions is lowered when an acid is diluted, increasing pH.

Click "**play**" to dilute these acids.

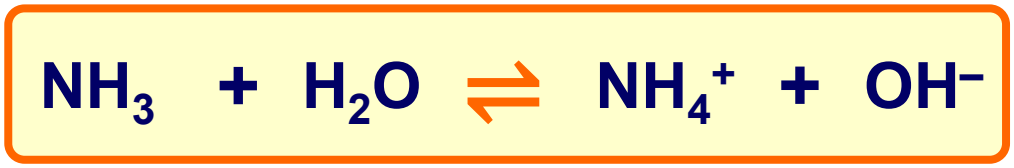




Properties of strong and weak alkalis

Alkalis can be classified as strong and weak in the same way as acids. A strong alkali, such as sodium hydroxide, fully dissociates in solution.

A weak alkali, such as ammonia, does not fully dissociate, and some of the OH^- ions are not released into solution.



Comparable levels of ion dissociation mean that strong and weak alkalis have similar properties to strong and weak acids.

Properties of strong and weak alkalis

What type of alkali do these statements relate to?

$0.1\,mol\,dm^{-3}$ NaOH	$0.1\,mol\,dm^{-3}$ NH_3

universal indicator turns green-blue

?

C

solve

Strong and weak acids and alkalis