

A2 Chemistry: F325 – Equilibria, Energetics and Elements

5.1.3 – Acids, bases and Buffers.

Lesson 1 - Brønsted–Lowry Acids and Bases

Learning Outcomes:

All

- State the meaning of the term acid and base (5.1.3 a)

Most

- Write an ionic equation for the reaction of an acid with metals, carbonates, bases and alkalis (5.1.3 b)

Some

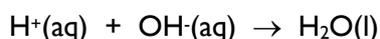
- Describe and use the term *conjugate acid– base pairs* and label them in an equation (5.1.3 c)

Background Information

The H⁺ ion is the active species in acids and is always involved in acid-base reactions.

- Bases are substances which react with and neutralise acids
- Alkalis are water-soluble bases which produce OH⁻ ions in aqueous solution. They
 - turn red litmus blue or UI paper blue
 - have a pH greater than 7
 - react with acids to form a salt and water only
 - NaOH(aq) + HCl(aq) → NaCl(aq) + H₂O(l)
 - form weak or strong alkalis depending on the equilibrium position
- Acids produce 'H⁺' ions in aqueous solution. They
 - turn blue litmus red or UI paper red
 - have a pH of less than 7
 - react with bases or alkalis to form a salt and water only
 - react with a metal carbonate to form a salt, carbon dioxide and water
 - 2HCl(aq) + CaCO₃(s) → CaCl₂(aq) + CO₂(g) + H₂O(l)
 - react with metals to form a salt and hydrogen
 - 2HNO₃(aq) + Mg(s) → Mg(NO₃)₂(aq) + H₂(g)
(The metal must be above hydrogen in the Reactivity Series)

- The reaction between an acid and an alkali is called neutralisation:



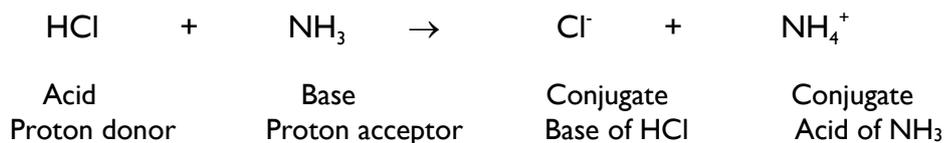
When an acid is added to water it dissociates releasing H⁺, hydrogen ions which is commonly called a proton as the hydrogen atom has lost an electron.



aq = excess
water

Different acids release different numbers of protons depending in their formulae. Acids that can release two protons are called di-basic acids, and those that can liberate three protons are called tri-basic acids.

- (a) The Bronsted-Lowry theory of acids and bases defines an acid as a proton donor and it may only function as such when in the presence of a proton acceptor – a base e.g.



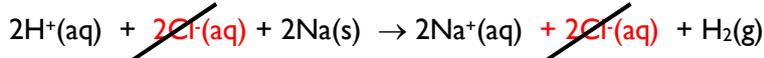
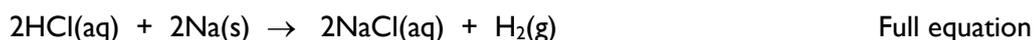
Explain the meaning of the terms conjugate acid and conjugate base and how an acid-base pair are linked together.

(b) Reactions with Acids

(i) Acids Reacting with Metals

When an aqueous acid reacts with a metal a salt and hydrogen gas is produced. You must be able to write a balanced full equation and an ionic equation for these reactions involving common mineral acids such as sulfuric acid (H₂SO₄), nitric acid HNO₃, hydrochloric acid HCl and phosphoric acid (H₃PO₄)

ACID + METAL → SALT + HYDROGEN



The spectator ions are removed from the equation. These are the ions that do not change their oxidation states during the reaction.



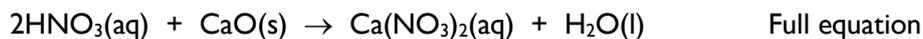
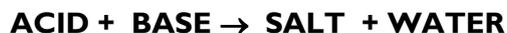
(ii) **Acids Reacting with Carbonates**



Ionic equation

(iii) **Acids Reacting with Bases**

A base is a soluble metal oxide.



Ionic equation

(iv) **Acids Reacting with Alkalis**



Ionic equation

Answer questions 1 and 2 on page 137.

Answer the questions on Acids, bases and Buffers 1.

