A-LEVEL CHEMISTRY • EXERCISE SHEET

7.2 Brønsted–Lowry theory of acids and bases

Name: _____ Class: _____ Date: _____ **Total: 12 marks**

Objective

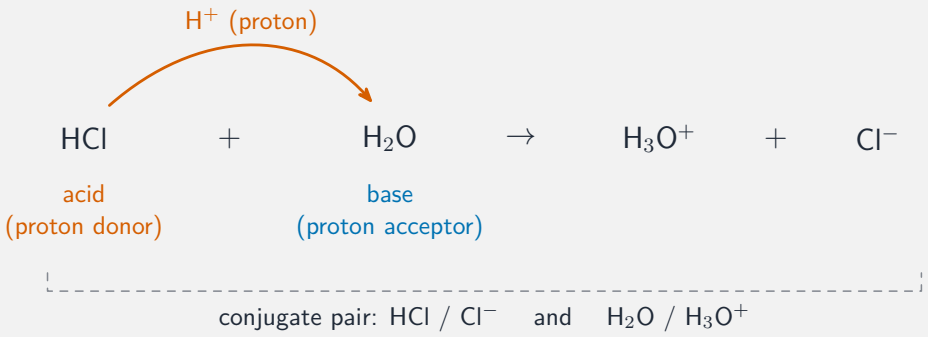
Build the skills to answer exam questions on the **Brønsted–Lowry theory** 布朗斯特-劳里理论—proton donors and acceptors, **strong and weak** 强弱 acids/bases, **neutralisation** 中和, and titration curves.

You must be able to:

- describe the Brønsted–Lowry theory and name the common acids and alkalis
- explain strong vs weak acids and how to tell them apart
- sketch titration curves and select a suitable indicator

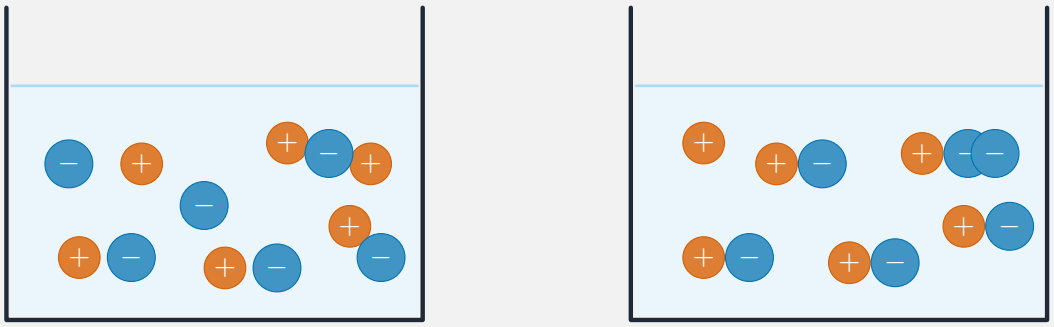
1 Worked examples

■ Brønsted–Lowry acids and bases



An acid is a proton (H^+) donor; a base is a proton acceptor —making two conjugate acid–base pairs

Common acids: HCl, H_2SO_4, HNO_3, CH_3COOH. Common alkalis: NaOH, KOH, NH_3.



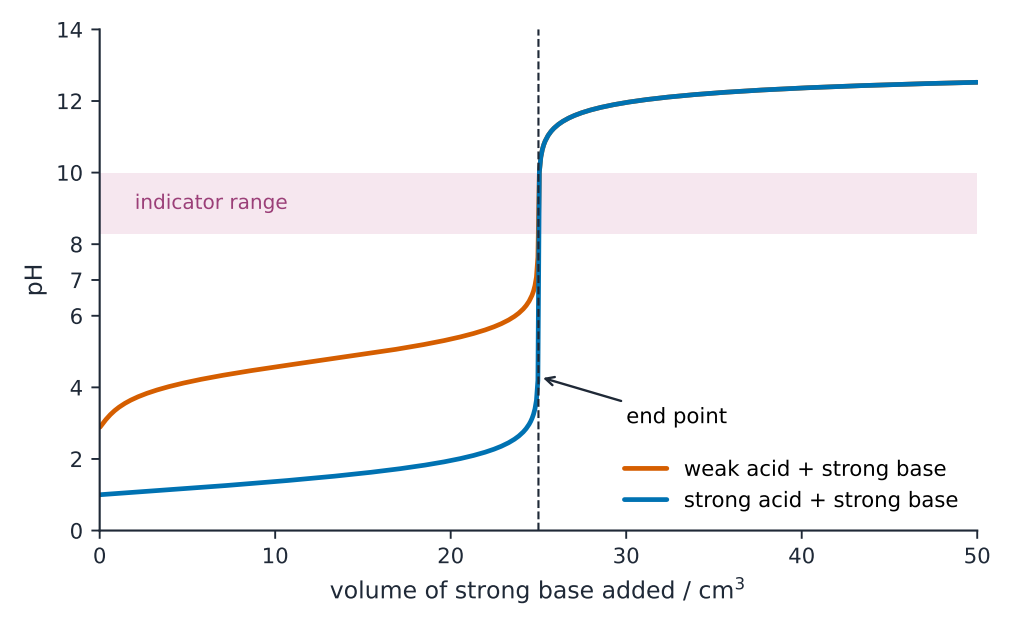
strong acid
fully dissociated: many ions

weak acid
mostly molecules: few ions

A strong acid is fully dissociated; a weak acid is only partly dissociated (not about concentration)

A strong acid has a **lower pH**, fizzes faster with a metal, and conducts better than a weak acid of the same concentration. **Neutralisation:** $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$, forming a **salt** 盐.

Titration curves and indicators



Choose an indicator whose colour change falls inside the steep pH jump

2 Practice

2.1 Define a Brønsted–Lowry **acid** and **base**. [2]

2.2 State the difference between a strong acid and a weak acid. [2]

3 Exam-style questions

3.1 In the Brønsted–Lowry theory, a base is a: [1]

- **A** proton donor
- **B** proton acceptor
- **C** electron donor
- **D** electron acceptor

3.2 Compared with a weak acid of the same concentration, a strong acid has a: [1]

- **A** higher pH
- **B** lower pH and more ions
- **C** smaller volume
- **D** larger molar mass

3.3 (a) Write the ionic equation for the neutralisation of an acid by an alkali. [1]

(b) Explain why a strong acid conducts electricity better than a weak acid of the same concentration. [2]

3.4 Explain how you would use a pH meter and a reactive metal to show that hydrochloric acid is a stronger acid than ethanoic acid of the same concentration. [3]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **7.2 Brønsted–Lowry theory of acids and bases** past-paper sheet in the Library, or try these in **Practice mode**:

- 9701/11 N25 —Q13 (acids and bases)
- 9701/11 N25 —Q14 (strong and weak acids)

Solutions

2.1 an acid is a proton (H) donor; a base is a proton acceptor.

2.2 a strong acid is fully dissociated into ions in water; a weak acid is only partly dissociated.

3.1 B. A base is a proton acceptor.

3.2 B. A strong acid is fully dissociated, giving more ions and a lower pH.

3.3 (a) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$.
(b) a strong acid is fully dissociated, so has more ions; more ions carry more charge, so it conducts better.

3.4 measure the pH of each with a pH meter —HCl gives a lower pH; add the same reactive metal to each —HCl fizzes faster; both show HCl has more H ions / is more dissociated, so it is stronger.