

8.1 Introduction to Acids and Bases

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS acid 酸 • base 碱 • weak 弱 • weak acid 弱酸 • strong 强

Objective

Build the skills to answer exam questions on **acids and bases** — the basic definitions.

You must be able to:

- use the **Brønsted-Lowry** definitions (proton donor / acceptor)
- distinguish **strong** 强 from **weak** 弱 acids and bases
- write the ionization of an acid in water

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ Brønsted-Lowry

An **acid** donates H^+ ; a **base** accepts H^+ . In water an acid produces H_3O^+ (hydronium); a base produces OH^- .

■ Strong vs weak

- A **strong** acid/base ionizes **completely** (HCl , NaOH) — a single arrow.
- A **weak** acid/base ionizes **partially** (CH_3COOH , NH_3) — an equilibrium arrow.

■ A worked ionization

Strong: $\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$ (complete). Weak: $\text{CH}_3\text{COOH} \rightleftharpoons \text{H}^+ + \text{CH}_3\text{COO}^-$ (partial, so a small K_a).

■ Recognising strong acids

The common strong acids are HCl , HBr , HI , HNO_3 , H_2SO_4 , HClO_4 . Assume other acids are weak.

2 Practice

Now apply the methods above.

2.1 Define a Brønsted-Lowry base. [1]

2.2 Write the ionization of the strong acid HNO_3 in water. [1]

2.3 Why is a weak acid written with an equilibrium arrow? [1]

3 Exam-style questions

3.1 A strong acid in water [1]

- **A** ionizes completely
 - **B** ionizes partially
 - **C** does not ionize
 - **D** forms OH^-
-

3.2 Compare HCl and CH_3COOH (acetic acid) at the same concentration.

(a) Which ionizes more? [1]

(b) Which has the higher $[\text{H}^+]$? Explain. [2]

3.3 Write the equilibrium for the weak base ammonia NH_3 reacting with water. [3]

Solutions

2.1 A proton (H^+) acceptor.

2.2 $\text{HNO}_3 \rightarrow \text{H}^+ + \text{NO}_3^-$.

2.3 It only ionizes partially, so an equilibrium exists between the molecule and its ions.

3.1 **A** — ionizes completely.

3.2 (a) HCl . (b) HCl — it is strong and ionizes completely, giving a higher $[\text{H}^+]$ than the partially-ionized weak acetic acid.

3.3 $\text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_4^+ + \text{OH}^-$.