AP CHEMISTRY • EXERCISE SHEET

8.1 Introduction to Acids and Bases

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

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: $HCl \rightarrow H^+ + Cl^-$ (complete). Weak: $CH_3COOH \rightleftharpoons H^+ + CH_3COO^-$ (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 $[H^+]$? Explain. [2]

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

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **8.1 Introduction to Acids and Bases** lesson on the **Learn** page;
- read the **Introduction to Acids and Bases** section of the AP Chemistry handout on the **Know** page.

Solutions

2.1 A proton (H^+) acceptor.

2.2 $HNO_3 \rightarrow H^+ + NO_3^-$.

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 $[H^+]$ than the partially-ionized weak acetic acid.

3.3 $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$.