

## 4.8 Acid-Base Reactions

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 12 marks

**KEY WORDS** brønsted-lowry 布朗斯特 • neutralization 中和 • conjugate acid-base pairs 共轭酸碱对  
• acid 酸 • base 碱

### Objective

Build the skills to answer exam questions on **acid-base reactions**.

You must be able to:

- identify **Brønsted-Lowry** 布朗斯特-劳里 acids (proton donors) and bases (proton acceptors)
- write **neutralization** 中和 as acid + base  $\rightarrow$  salt + water
- identify **conjugate acid-base pairs** 共轭酸碱对

### 1 Worked examples

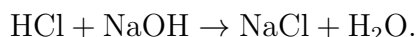
Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

#### ■ Brønsted-Lowry definition

An **acid** donates a proton ( $\text{H}^+$ ); a **base** accepts one. In  $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$ , HCl donates ( $\rightarrow$  acid), water accepts ( $\rightarrow$  base).

#### ■ Neutralization

Acid + base  $\rightarrow$  **salt** + **water**:



The net ionic form is  $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$ .

#### ■ Conjugate pairs

When an acid donates its proton, what remains is its **conjugate base**. HCl (acid)  $\rightarrow \text{Cl}^-$  (conjugate base).  $\text{H}_2\text{O}$  (base)  $\rightarrow \text{H}_3\text{O}^+$  (conjugate acid). A pair differs by **one  $\text{H}^+$** .

#### ■ Identifying pairs

Look for two species that differ by a single proton on each side of the equation.

## 2 Practice

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Now apply the methods above.

**2.1** Define a Brønsted-Lowry acid. [1]

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**2.2** Write the products of  $\text{HNO}_3 + \text{KOH}$ . [2]

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**2.3** What is the conjugate base of HF? [1]

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## 3 Exam-style questions

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**3.1** A Brønsted-Lowry base is a [1]

- **A** proton donor
  - **B** proton acceptor
  - **C** electron donor
  - **D** hydroxide only
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**3.2** Consider  $\text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_4^+ + \text{OH}^-$ .

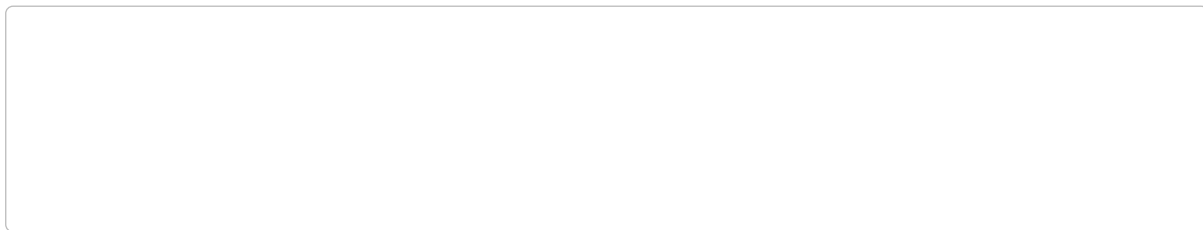
(a) Identify the acid and base on the left. [2]

(b) Identify the conjugate acid-base pairs. [2]

**3.3** Write the balanced molecular equation for the neutralization of sulfuric acid  $\text{H}_2\text{SO}_4$

with sodium hydroxide.

[3]



## Solutions

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**2.1** A proton ( $\text{H}^+$ ) donor.

**2.2**  $\text{KNO}_3 + \text{H}_2\text{O}$  (salt + water).

**2.3**  $\text{F}^-$ .

**3.1** **B** — a proton acceptor.

**3.2** (a)  $\text{H}_2\text{O}$  is the acid (donates  $\text{H}^+$ );  $\text{NH}_3$  is the base (accepts). (b)  $\text{NH}_3/\text{NH}_4^+$  and  $\text{H}_2\text{O}/\text{OH}^-$ .

**3.3**  $\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ .