

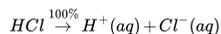
### 1.11.3: Strong and Weak Acids and Bases

#### Learning Objectives

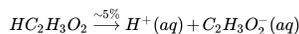
- Define a strong and a weak acid and base.
- Recognize an acid or a base as strong or weak.
- Determine if a salt produces an acidic or a basic solution.

#### Strong and Weak Acids

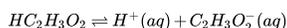
Except for their names and formulas, so far we have treated all acids as equals, especially in a chemical reaction. However, acids can be very different in a very important way. Consider HCl(aq). When HCl is dissolved in H<sub>2</sub>O, it completely dissociates into H<sup>+</sup>(aq) and Cl<sup>-</sup>(aq) ions; all the HCl molecules become ions:



Any acid that dissociates 100% into ions is called a **strong acid**. If it does not dissociate 100%, it is a **weak acid**. HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub> is an example of a weak acid:



Because this reaction does not go 100% to completion, it is more appropriate to write it as a **reversible reaction**:



As it turns out, there are very few strong acids, which are given in Table 1.11.3.1. If an acid is not listed here, it is a weak acid. It may be 1% ionized or 99% ionized, but it is still classified as a weak acid.

*Any acid that dissociates 100% into ions is called a strong acid. If it does not dissociate 100%, it is a weak acid.*

Table 1.11.3.1: Strong Acids and Bases

Acids	Bases
HCl	LiOH
HBr	NaOH
HI	KOH
HNO <sub>3</sub>	RbOH
H <sub>2</sub> SO <sub>4</sub>	CsOH
HClO <sub>3</sub>	Mg(OH) <sub>2</sub>
HClO <sub>4</sub>	Ca(OH) <sub>2</sub>
	Sr(OH) <sub>2</sub>
	Ba(OH) <sub>2</sub>

#### Strong and Weak Bases

The issue is similar with bases: a **strong base** is a base that is 100% ionized in solution. If it is less than 100% ionized in solution, it is a **weak base**. There are very few strong bases (Table 1.11.3.1); any base not listed is a weak base. All strong bases are OH<sup>-</sup> compounds. So a base based on some other mechanism, such as NH<sub>3</sub> (which does not contain OH<sup>-</sup> ions as part of its formula), will be a weak base.

#### Example 1.11.3.1: Identifying Strong and Weak Acids and Bases

Identify each acid or base as strong or weak.

- HCl
- Mg(OH)<sub>2</sub>
- C<sub>5</sub>H<sub>5</sub>N

#### Solution

- Because HCl is listed in Table 1.11.3.1, it is a strong acid.
- Because Mg(OH)<sub>2</sub> is listed in Table 1.11.3.1, it is a strong base.
- The nitrogen in C<sub>5</sub>H<sub>5</sub>N would act as a proton acceptor and therefore can be considered a base, but because it does not contain an OH compound, it cannot be considered a strong base; it is a weak base.

#### Exercise 1.11.3.1

Identify each acid or base as strong or weak.

- RbOH
- HNO<sub>2</sub>

#### Answer a

strong base

#### Answer b

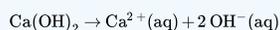
weak acid

#### Example 1.11.3.2: Characterizing Base Ionization

Write the balanced chemical equation for the dissociation of Ca(OH)<sub>2</sub> and indicate whether it proceeds 100% to products or not.

#### Solution

This is an ionic compound of Ca<sup>2+</sup> ions and OH<sup>-</sup> ions. When an ionic compound dissolves, it separates into its constituent ions:



Because Ca(OH)<sub>2</sub> is listed in Table 1.11.3.1, this reaction proceeds 100% to products.

**? Exercise 1.11.3.2**

Write the balanced chemical equation for the dissociation of hydrazoic acid ( $\text{HN}_3$ ) and indicate whether it proceeds 100% to products or not.

**Answer a**

The reaction is as follows:



It does not proceed 100% to products because hydrazoic acid is not a strong acid.

**Key Takeaways**

- Strong acids and bases are 100% ionized in aqueous solution.
- Weak acids and bases are less than 100% ionized in aqueous solution.
- Salts of weak acids or bases can affect the acidity or basicity of their aqueous solutions.

**Contributions & Attributions**

1.11.3: [Strong and Weak Acids and Bases](#) is shared under a [not declared](#) license and was authored, remixed, and/or curated by LibreTexts.

- 14.7: [Strong and Weak Acids and Bases](#) by Henry Agnew, Marisa Alviar-Agnew is licensed [CK-12](#). Original source: <https://www.ck12.org/c/chemistry/>.

