

Salts

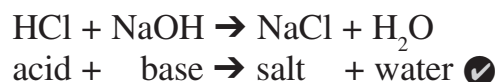
Textbook pages 234–243

Before You Read

How many different uses for salts can you name? Write your answers on the lines below.

What are salts?

In chemistry, **salts** are a class of ionic compounds that can be formed during the reaction of an acid and a base. A salt is made up of a positive ion from a base and a negative ion from an acid. An acid and a base react to form a salt and water in a chemical reaction called a **neutralization (acid-base)** reaction. For example:



Which other compounds react with acids to produce salts?

Acids can also react with metals and carbonates to produce salts

1. Metals: When metals react with acids to produce a salt, they usually release hydrogen gas, as shown below.



The most reactive metals are the **alkali metals** and alkaline **earth metals**, which appear on the extreme left of the periodic table. Within these groups, the elements at the bottom of the columns react the most vigorously.

2. Carbonates: Carbonates can also react with acids to produce salts. Much of the carbon dioxide on the surface of Earth is trapped in rocks, such as limestone, dolomite, and calcite, which contain carbonate ions. When carbonate rocks react with acids, such as those in acid precipitation, the carbonates help to neutralize the acid. Sulphuric acid is one component of acid precipitation.



Identify Concepts

Highlight each question head in this section. Then use a different colour to highlight the answers to the questions.



What is a salt?

continued

The chemical reaction between this acid and carbonate releases carbon dioxide gas, as shown below.

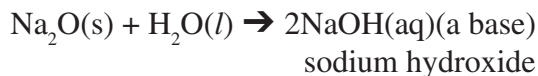


What are oxides?

An **oxide** is a chemical compound that includes at least one oxygen atom or ion along with one or more other elements.

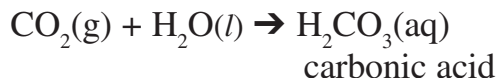
Both metals and non-metals can form oxides. ✓

1. **Metal oxides:** A **metal oxide** is a chemical compound that contains a metal chemically combined with oxygen. A metal oxide, such as sodium oxide, combines with water to form a base (see below).



The base can then react chemically with an acid to form a salt.

2. **Non-metal oxides:** A **non-metal oxide** is a chemical compound that contains a non-metal chemically combined with oxygen. A non-metal oxide, such as carbon dioxide, combines with water to form an acid.



This acid can react chemically with a base to form a salt.

✓ Reading Check

Which type of oxide combines with water to form a base?

Use with textbook pages 234–239.

Recognizing acids, bases, and salts

1. State whether each of the following is an acid, a base, or a salt.

- | | |
|------------------------------------|--|
| (a) HI _____ | (l) $\text{Al}_2(\text{SO}_4)_3$ _____ |
| (b) HBr _____ | (m) CH_3COOH _____ |
| (c) KOH _____ | (n) $\text{Mg}(\text{CH}_3\text{COO})_2$ _____ |
| (d) HNO_3 _____ | (o) calcium nitrate _____ |
| (e) NaOH _____ | (p) sodium chloride _____ |
| (f) H_2SO_4 _____ | (q) hydrocyanic acid _____ |
| (g) H_2CO_3 _____ | (r) hydrogen fluoride _____ |
| (h) H_3PO_4 _____ | (s) barium hydroxide _____ |
| (i) Na_3PO_4 _____ | (t) hypochlorous acid _____ |
| (j) $\text{Sr}(\text{OH})_2$ _____ | (u) aluminum hydroxide _____ |
| (k) $\text{Ca}(\text{OH})_2$ _____ | (v) magnesium carbonate _____ |

2. What acid is present in vinegar? _____
3. What is the chemical name for table salt? _____
4. What acid is used in automobile batteries? _____
5. What base is found in drain and oven cleaners? _____
6. What base is the active ingredient in some antacids? _____
7. What acid is produced in the stomach to help digest food? _____

Name _____

Date _____

Use with textbook pages 234–239.

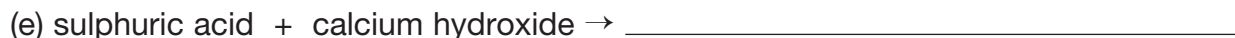
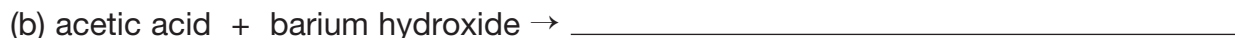
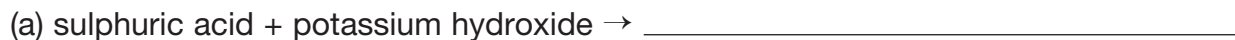
Acid-base neutralization reactions



1. Complete and balance the following neutralization reactions.



2. Complete and balance the following acid-base neutralization reactions. Include both the word equation and the formula.



Use with textbook pages 237.

Metal oxides and non-metal oxides

1. What element reacts with a metal or a non-metal to form an oxide?

2. What is a chemical compound that contains a metal chemically combined with oxygen? _____
3. What is a chemical compound that contains a non-metal chemically combined with oxygen? _____
4. What happens to a solution when a metal oxide dissolves in water?

5. What happens to a solution when a non-metal oxide dissolves in water?

6. What is formed when a metal oxide reacts with water? _____
7. What is formed when a non-metal oxide reacts with water?

8. Classify each of the following as a metal oxide or a non-metal oxide.
 - (a) Na_2O _____
 - (b) B_2O_3 _____
 - (c) NO_2 _____
 - (d) CaO _____
 - (e) SO_2 _____
 - (f) BeO _____
 - (g) ClO _____
 - (h) Li_2O _____
9. Indicate whether an acid or a base will be produced.
 - (a) $\text{MgO} + \text{H}_2\text{O} \rightarrow$ _____
 - (b) $\text{SO}_3 + \text{H}_2\text{O} \rightarrow$ _____
 - (c) $\text{CaO} + \text{H}_2\text{O} \rightarrow$ _____
 - (d) $\text{CO}_2 + \text{H}_2\text{O} \rightarrow$ _____

Use with textbook pages 234–239.

Salts

Match the Term on the left with the best Chemical Formula on the right. Each Chemical Formula may be used only once.

Term	Chemical Formula
1. _____ water	A. H ₂ O
2. _____ a salt	B. NO ₂
3. _____ a base	C. MgCl
4. _____ an acid	D. Na ₂ O
5. _____ a metal oxide	E. H ₂ CO ₃
6. _____ a non-metal oxide	F. NH ₄ OH

7. Which of the following metals is most reactive?

- A.** copper
- B.** sodium
- C.** francium
- D.** magnesium

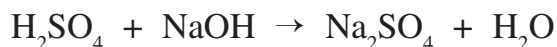
8. When non-metal oxides dissolve in water, the solution becomes

- A.** basic
- B.** acidic
- C.** neutral

9. Carbon dioxide forms which of the following in water?

- A.** CO
- B.** CO₃²⁻
- C.** HCO₃⁻
- D.** H₂CO₃

10. What coefficient is needed for sodium hydroxide in order to balance the following equation?



- A.** 1 **C.** 3
- B.** 2 **D.** 4

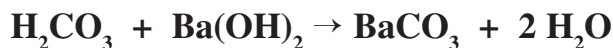
11. Hydrochloric acid can be used to neutralize potassium hydroxide. What is the formula for the salt produced by this neutralization?

- A.** H₂O
- B.** KCl
- C.** KClO₂
- D.** KClO₃

12. Which reactants form the salt FePO₄ in a neutralization reaction?

- A.** PO₄ and Fe₂O₃
- B.** H₃P and Fe(OH)₃
- C.** H₂O and Fe(OH)₃
- D.** H₃PO₄ and Fe(OH)₃

Use the following acid-base neutralization reaction to answer question 13.



13. Which of the following statements is true?

I.	H ₂ CO ₃ is an acid.
II.	BaCO ₃ is a base.
III.	The products of this reaction are a salt and water.

- A.** I and II only
- B.** I and III only
- C.** II and III only
- D.** I, II, and III