Neutralization Reactions
Mixing Acids & Bases
Acid/Base Neutralization

- A **salt** is any compound that can be derived from the neutralization of an acid and a base.
- The word "**neutralization**" is used because the acid and base properties of H+ and OH- are destroyed or neutralized.
- In the reaction, H+ and OH- combine to form HOH or H₂O (water molecules).
- A neutralization reaction is a type of **double replacement** reaction.
Writing neutralization equations

When acids and bases are mixed, a salt forms:

\[
\text{NaOH} + \text{HCl} \rightarrow \text{H}_2\text{O} + \text{NaCl}
\]

The cation (metal) from the base and the anion acid join to form the salt. The OH from the base and the H from the acid join to form water.
Example: Write the chemical reaction when lithium hydroxide is mixed with carbonic acid.

Step 1: write out the reactants

\[ \text{LiOH} \quad + \quad \text{H}_2\text{CO}_3 \quad \rightarrow \quad \text{Li}_2\text{CO}_3 \quad + \quad \text{H}_2\text{O} \]

Step 2: determine products… (make sure the salt is written with correct subscripts! Refer to Oxidation Chart.)

Remember the “criss-cross” method-Ch. 20
Step 3: balance the equation

\[ 2\text{LiOH} + \text{H}_2\text{CO}_3 \rightarrow \text{Li}_2\text{CO}_3 + 2\text{H}_2\text{O} \]

lithium hydroxide + carbonic acid → lithium carbonate + water
Example: Complete the neutralization reaction...

$$Ca(OH)_2 + H_2SO_4 \rightarrow$$

Step 1: already completed for you

$$Ca(OH)_2 + H_2SO_4 \rightarrow$$

Step 2: determine products... (make sure the salt is written with correct subscripts! Refer to Oxidation Chart.)

$$H_2O + CaSO_4$$

Charge of cation equals the charge of the anion... no need to add subscripts.
Writing neutralization equations

Step 3: balance the equation

\[ \text{Ca(OH)}_2 + \text{H}_2\text{SO}_4 \rightarrow 2\text{H}_2\text{O} + \text{CaSO}_4 \]

calcium hydroxide + sulfuric acid → calcium sulfate + water

Remember balancing equations…
Ch. 21 (use coefficients only)
Writing neutralization equations

Example: Complete the neutralization reaction…
iron(II) hydroxide + phosphoric acid
Step 1: write out the reactants …(make sure the acid and base are written with correct subscripts! Oxidation Chart.)

Think “criss-cross” Method.

Fe(OH)$_2$ + $\text{H}_3\text{PO}_4$ →

Fe(OH)$_2$ + $\text{H}_3\text{PO}_4$ →
Writing neutralization equations

Step 2: determine products… (Is the salt written with correct subscripts? Oxidation Chart.)

\[
\text{Fe(OH)}_2 + \text{H}_3\text{PO}_4 \rightarrow \\
\text{H}_2\text{O} + \text{Fe}_3(\text{PO}_4)_2
\]

Step 3: balance the equation

\[
3\text{Fe(OH)}_2 + 2\text{H}_3\text{PO}_4 \rightarrow 6\text{H}_2\text{O} + \text{Fe}_3(\text{PO}_4)_2
\]

Remember balancing equations… Ch. 21 (use coefficients only)

iron II hydroxide + phosphoric acid \(\rightarrow\) iron II phosphate + water
Practice

Write balanced chemical equations for these neutralization reactions.

1) Ba(OH)$_2$ + HCl

2) calcium hydroxide + nitric acid

3) Al(OH)$_3$ + H$_2$SO$_4$

4) KOH + HClO$_2$
a) \( \text{Ba(OH)}_2 + 2\text{HCl} \rightarrow \text{BaCl}_2 + 2\text{H}_2\text{O} \)
barium hydroxide + hydrochloric acid \( \rightarrow \) barium chloride

b) \( \text{Ca(OH)}_2 + 2\text{HNO}_3 \rightarrow \text{Ca(NO}_3)_2 + 2\text{H}_2\text{O} \)
calcium hydroxide + nitric acid \( \rightarrow \) calcium nitrate

c) \( 2\text{Al(OH)}_3 + 3\text{H}_2\text{SO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 6\text{H}_2\text{O} \)
aluminum hydroxide + sulfuric acid \( \rightarrow \) aluminum sulfate

d) \( \text{KOH} + \text{HClO}_2 \rightarrow \text{KClO}_2 + \text{H}_2\text{O} \)
potassium hydroxide + chlorous acid \( \rightarrow \) potassium chlorite