

- Acids turn blue litmus red while bases turn red litmus blue.
- According to the Arrhenius definition, an acid is a substance that produces H⁺ (hydrogen ions) in dilute aqueous solution.
For example: $\text{HCl (aq)} \rightarrow \text{H}^+ \text{ (aq)} + \text{Cl}^- \text{ (aq)}$
- According to the Arrhenius definition, a base is a substance that produces OH⁻ (hydroxide ions) in dilute aqueous solution.
For example: $\text{NaOH(aq)} \rightarrow \text{Na}^+ \text{ (aq)} + \text{OH}^- \text{ (aq)}$
- There are seven common strong acids. These acids are labeled strong because they completely ionize. The names and formulas of these acids are:

HCl	hydrochloric acid
HBr	hydrobromic acid
HI	hydroiodic acid
HNO₃	nitric acid
HClO₃	chloric acid
HClO₄	perchloric acid
H₂SO₄	sulfuric acid
- There are eight common strong bases. They are all hydroxides and their names and formulas are:

LiOH	lithium hydroxide
NaOH	sodium hydroxide
KOH	potassium hydroxide
RbOH	rubidium hydroxide
CsOH	cesium hydroxide
Ca(OH)₂	calcium hydroxide
Sr(OH)₂	strontium hydroxide
Ba(OH)₂	barium hydroxide
- An acid that ionizes very slightly in dilute aqueous solution is classified as a weak acid.
- The name and formula of the most common weak base are NH₃, ammonia. Just like a weak acid, a weak base also partially ionizes.
- All hydroxides that are not strong bases are NOT weak bases, instead they are classified as insoluble bases.
- Acids that are composed of two elements, a hydrogen and a non-metal, are termed binary acids.
- Acids that are composed of three elements, hydrogen, oxygen and a non-metal are termed ternary or oxy- acids.
- Acids that contain the COOH (carboxyl) group are called organic or carboxylic acids.
- Among the following acids, HNO₃, HCOOH, HClO₄, H₃PO₄, CH₃COOH, H₂CO₃, the organic acids are HCOOH and CH₃COOH.
- There are three strong binary acids.
- There are four strong ternary acids.

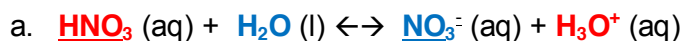
15. Classify each of the following compounds as a strong acid (SA), a weak acid (WA), a strong base (SB), a weak base (WB), or an insoluble base (IB):

Ca(OH) ₂	<u>SB</u>	HClO ₄	<u>SA</u>
CH ₃ CH ₂ COOH	<u>WA</u>	LiOH	<u>SB</u>
NaOH	<u>SB</u>	Cu(OH) ₂	<u>IB</u>
H ₃ PO ₄	<u>WA</u>	H ₂ SO ₄	<u>SA</u>
Sr(OH) ₂	<u>SB</u>	H ₂ S	<u>WA</u>
CsOH	<u>SB</u>	HCN	<u>WA</u>
HCOOH	<u>WA</u>	HF	<u>WA</u>
NH ₃	<u>WB</u>	LiOH	<u>SB</u>
Fe(OH) ₃	<u>IB</u>	H ₂ SO ₃	<u>WA</u>
CH ₃ NH ₂	<u>WB</u>	HNO ₃	<u>SA</u>
HI	<u>SA</u>	Cu(OH) ₂	<u>IB</u>
HClO	<u>WA</u>	Mg(OH) ₂	<u>IB</u>
HBrO ₂	<u>WA</u>	H ₂ CO ₃	<u>WA</u>

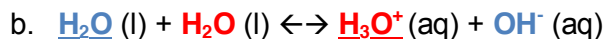
16. According to the Bronsted-Lowry definition, an acid is defined as a **proton** donor, and a base is defined as a proton **acceptor**.

17. List the Bronsted-Lowry conjugate acid base partners in the following reactions:

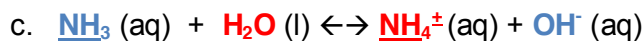
Acids are in red, bases are in blue. One conjugate "pair" is underlined, the other not.



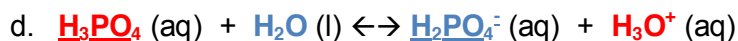
Nitric acid is a B-L acid, and its conjugate base is the nitrate ion. Likewise, water is the conjugate base of hydronium.



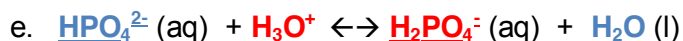
Water is amphoteric, meaning it can be an acid or a base. Its conjugate acid is hydronium, and its conjugate base is hydroxide.



Ammonia is a B-L base, and its conjugate acid is ammonium. Water serves as an acid in this instance.



Phosphoric acid is a B-L acid, and its conjugate base is the dihydrogen phosphate anion. Water serves as a base.



The hydrogen phosphate anion is a B-L base, and its conjugate acid is the dihydrogen phosphate anion. The hydronium ion donates a proton in this reaction to form its conjugate base, water.