

Clker-Free-Vector-Images (Pixabay)

---

---

---

---

---

---

---

---

### Around the House

<p><b>Acids</b></p> <ul style="list-style-type: none"> <li>• Fruit juice</li> <li>• Vinegar</li> <li>• Milk</li> </ul>	<p><b>Bases</b></p> <ul style="list-style-type: none"> <li>• Soap</li> <li>• Toothpaste</li> <li>• Baking Soda</li> </ul>
--	---








Oranges – Ant & Carrie Coleman (CC BY-NC-ND 2.0)  
 Heinz Vinegar – Mike Mozart (CC BY 2.0)  
 Milk – World's Direction (public domain)

Soap – Lora (CC BY-NC-ND 2.0)  
 Toothpaste – Maksym Yemelyanov (Adobe Stock)  
 Arm & Hammer Baking Soda – Willis Lam (CC BY-SA 2.0)

---

---

---

---

---

---

---

---

### Properties

<p><b>Acids</b></p> <ul style="list-style-type: none"> <li>• Taste sour</li> <li>• React with metals to produce hydrogen gas</li> </ul>	<p><b>Bases</b></p> <ul style="list-style-type: none"> <li>• Taster bitter</li> <li>• Feel slippery</li> </ul>
---	--

---

---

---

---

---

---

---

---

## Indicators

- Indicators allow us to determine whether a substance is an acid or a base.



Image: Aris Suwanmalee (Adobe Stock)

---

---

---

---

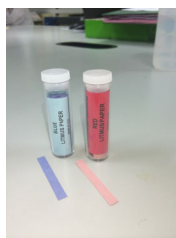
---

---

---

---

- Litmus Paper
  - Red = Acid
  - Blue = Base



Blue and Red litmus papers – Kanesskong (CC BY-SA 4.0)

- Phenolphthalein
  - Clear = Acid
  - Pink = Base



Phenolphthalein at pH of 9 (public domain)

---

---

---

---

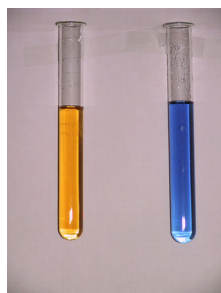
---

---

---

---

- Bromthymol Blue
  - Yellow = Acid
  - Blue = Base



Bromthymol blue – Xato (CC BY-SA 3.0)

- Universal Indicator
  - Color depends on how acidic or basic a solution is.



Pack of litmus test paper and color samples – Coprid (Adobe Stock)

---

---

---

---

---

---

---

---

## pH

- Water has an equal number of  $H^+$  and  $OH^-$  ions.
  - Water is neutral.
- When an acid is dissolved in water it releases  $H^+$  ions (increasing the overall number of  $H^+$  ions).
- If the number of  $H^+$  ions is greater than the number of  $OH^-$  ions, the solution is acidic.
- The more  $H^+$  ions, the stronger the acid.

---

---

---

---

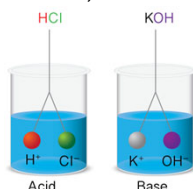
---

---

---

---

- When a base is dissolved in water, it releases  $OH^-$  ions (increasing the overall number of  $OH^-$  ions in the water).
- If the number of  $OH^-$  ions is greater than the number of  $H^+$  ions, the solution is basic.
- The more  $OH^-$  ions, the stronger the base.



koray (Adobe Stock)

---

---

---

---

---

---

---

---

- The pH (power of hydrogen) of a solution is calculated from the number of  $H^+$  ions in the solution.
  - It is, therefore, a value that represents how acidic or basic a solution is.
- The range of pH values (scale) is 0 to 14.
- Acids have a  $pH < 7$ .
- Bases have a  $pH > 7$ .
- A neutral substance (neither an acid nor base) has a pH of 7.

---

---

---

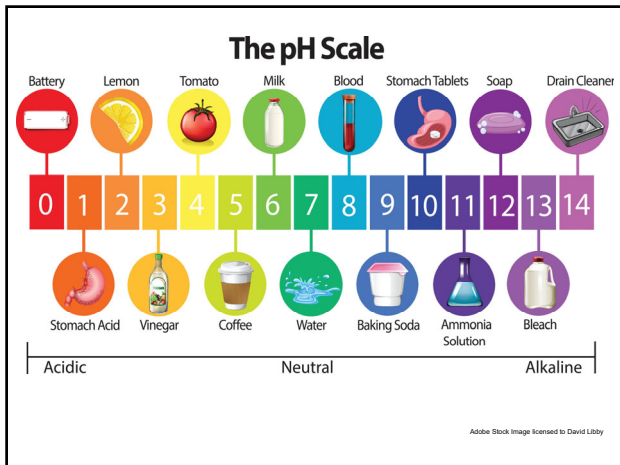
---

---

---

---

---



---

---

---

---

---

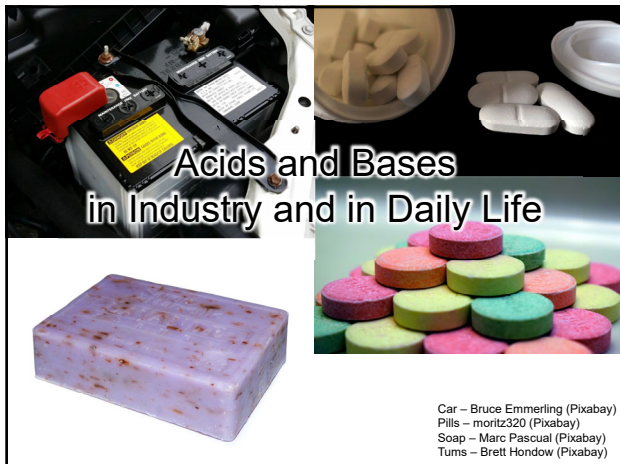
---

---

---

---

---



---

---

---

---

---

---

---

---

---

---

- hydrochloric acid, HCl
  - stomach acid; used in cleaning (refining) metals; maintenance of swimming pools; household cleaning
- sulfuric acid, H<sub>2</sub>SO<sub>4</sub>
  - car batteries; manufacture of fertilizers and many other commercial products
- nitric acid, HNO<sub>3</sub>
  - manufacture of fertilizers, explosives; extraction of gold
- acetic acid, HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>
  - vinegar

---

---

---

---

---

---

---

---

---

---

- carbonic acid,  $\text{H}_2\text{CO}_3$ 
  - carbonated drinks
- citric acid,  $\text{C}_6\text{H}_8\text{O}_7$ 
  - food; dietary supplements; creams, gels, liquids, and lotions.
- acetylsalicylic acid,  $\text{C}_6\text{H}_4(\text{OCOCH}_3)\text{CO}_2\text{H}$ 
  - aspirin

---

---

---

---

---

---

---

---

- sodium hydroxide,  $\text{NaOH}$ 
  - soaps and detergents; oven and drain cleaners
- potassium hydroxide,  $\text{KOH}$ 
  - liquid soaps and soft soaps; alkaline batteries
- magnesium hydroxide,  $\text{Mg}(\text{OH})_2$ 
  - laxatives, antacids, and deodorants; used in the neutralization of acidic wastewater
- calcium hydroxide,  $\text{Ca}(\text{OH})_2$ 
  - antacids; manufacture of cement and lime water; added to neutralize acidic soil.

---

---

---

---

---

---

---

---

- aluminum hydroxide,  $\text{Al}(\text{OH})_3$ 
  - water purification; antacids
- ammonia,  $\text{NH}_3$ 
  - Used as a building block for the synthesis of many pharmaceutical products; cleaning products; manufacture of fertilizers

---

---

---

---

---

---

---

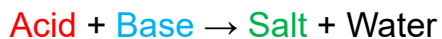
---

## Neutralization Reaction



Kindel Media (Pexels)

- The reaction between an acid and a base is a special kind of double displacement reaction called **neutralization**.
- An acid and base react together to form a salt and water.
  - A salt is an ionic solid consisting of a positive ion (other than hydrogen) and a negative ion (other than hydroxide).



Examples:

