

Acids and Bases

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What are acids and bases? (**Brainstorm**)
You see them in your everyday life!!!

7 is neutral
pH below 7 = acid
pH above 7 = basic/alkaline.

Examples:

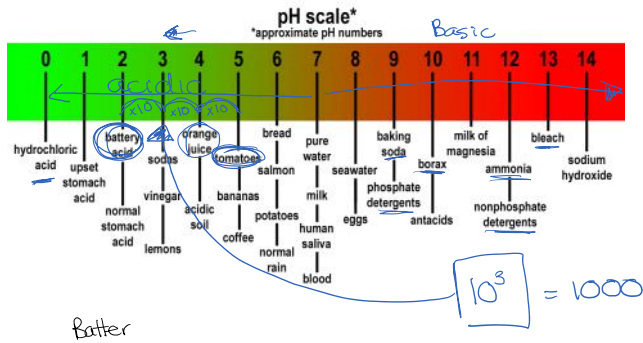
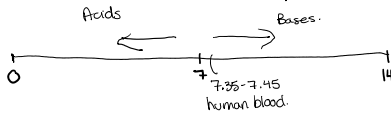
Acids - Vinegar, Lemon Juice, Tomatoes, Milk

Bases - Soap, Bleach, Ammonia, Baking Soda, Eggs

Substances that are neither acidic nor basic are **Neutral**.

Acids and bases are classified using a pH scale. The pH scale determines how acidic or how basic a solution is. pH level is based on the percentage of hydrogen ion's in a solution.

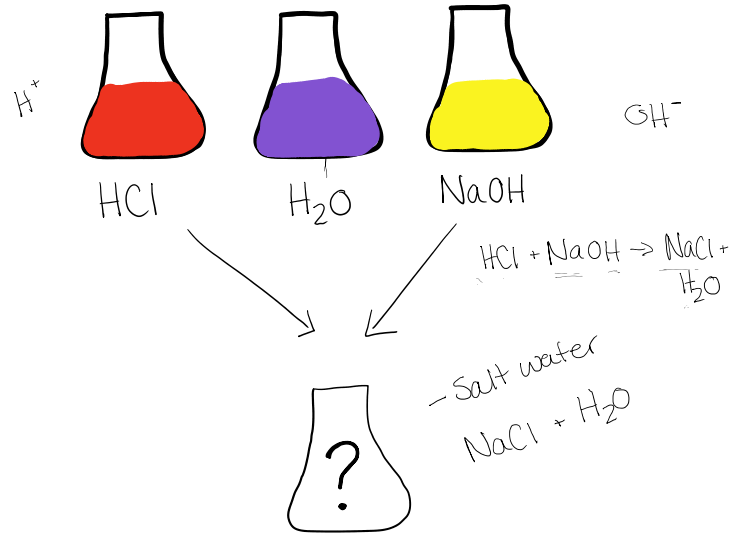
- The pH Scale ranges from 0 - 14.
- 7 is considered to be neutral
- pH of a solution below 7 is considered **acidic**
- pH of a solution above 7 is considered **Basic/Alkaline**



• If we take a strong acid = HCl (hydrochloric acid) and combine it with a strong base = NaOH (sodium hydroxide)

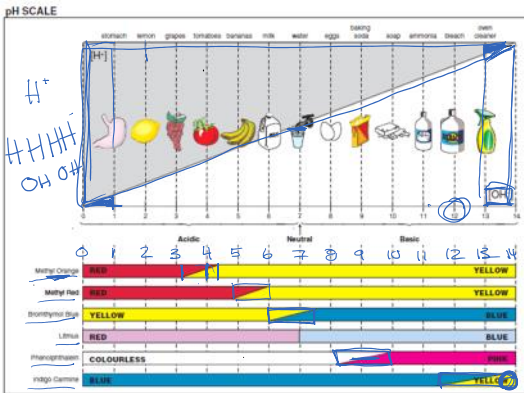
What would happen?

* make your predictions...



Now, what if we evaporate the H₂O?

	Acid	Base
Taste CAUTION: You should NEVER taste chemicals in the lab!!	• Taste Sour and tangy	Taste bitter
Touch CAUTION: You should NEVER touch chemicals in the lab!!	• Strong acids will burn your skin. • Can be corrosive	• Bases feel slippery • Strong bases will burn your skin. • Can be caustic



Acids - Contain H⁺ ions

Bases - Contain OH⁻ ions

pH Indicators

Many acids and bases form colourless solutions and can be extremely difficult to determine if it could be harmful. One way to test an unknown solution is to use a pH indicator.

pH indicators are: solutions that change colour depending on pH

A common indicator used to determine if a solution is an Acid or a Base is to use Litmus paper

- Blue Litmus** paper in an **Acidic** solution will turn the paper **Red**
- Red Litmus** paper in an **Basic** (or Alkaline) solution will turn the paper **blue**

Table 5.1 Acid-Base Indicators

Acid-base indicator	pH Range in Which Colour Change Occurs	Colour Change as pH Increases
Methyl orange	3.2–4.4	red to yellow
Methyl red	4.8–6.0	red to yellow
Bromothymol blue	6.0–7.6	yellow to blue
Litmus	7.0	red to blue
Phenolphthalein	8.2–10.0	colourless to pink
Indigo carmine	11.2–13.0	blue to yellow

Check for Understanding

1. What is the pH scale?
2. When the pH changes from 7 → 3 how many times more acidic does the solution become?
3. What colour of litmus paper changes colour in an acidic solution?
4. What colour is Methyl Orange at the following pH?
 - a. pH 2
 - b. pH 3.5
 - c. pH 10

Acids

You can sometimes identify acids based on their chemical formula. Many compounds only take on acidic properties when dissolved in water, and will be written with a subscript of (aq) meaning aqueous or will be stated that it is "dissolved in water to make a solution". Chemical formulas of acids typically have the H written on the left side of the formula, like HCl, however, when Carbon is in the acid H may be written on the right hand side (vinegar: CH₃COOH(aq)).

Naming Acids

- When an acid is stated to be dissolved in water the ending _____ is used.
 - HCl(aq) Hydrochlor_____
- Acids that contain Oxygen and begin with Hydrogen and end in **-ate** can be changed by dropping the Hydrogen and adding ic acid
 - H₂CO₃ – Hydrogen Carbonate will become Carbonic Acid **when dissolved in water**
- Acids that contain Oxygen, begin with Hydrogen and end in **-ite** can be changed by dropping Hydrogen and changing the end to ous acid
 - H₂SO₃ – Hydrogen Sulphite will become Sulfurous acid **when dissolved in water.**

Lite hous ate a tick

Bases

You can identify bases by their chemical formulas as they are written with an OH on the right side of their formula. These chemical names can be easily recognized by 'hydroxide' written last. Example NaOH → Sodium Hydroxide

Production of Ions

Basic and Acidic solutions can conduct electricity because it contains freely moving ions.

Acids produce: _____ when dissolved

Bases produce: _____ when dissolved

Concentration of ions refers to the number of Hydrogen ions in a specific volume of solution. The higher the concentration of H⁺ the more _____ a solution is. Similarly, the higher the concentration of OH⁻ ions, the more _____ a solution is.

- If a solution contains both H⁺ and OH⁻ ions they will react with each other forming H₂O. This reaction is a neutralization where the acids and bases are in balance.



Mining operations in British Columbia result in large volumes of rock being ground up and processed. After the valuable minerals have been removed, the remaining ground rock, called tailings, is usually deposited in a tailings pond (Figure 5.11). Sometimes the tailings release acids, which lower the pH of the water in the pond and affect the surrounding environment. One way to combat this problem is to add a base to the pond to raise the pH to normal levels.



Table 5.3 Some Non-Oxygen Acids

Formula	Chemical Name	Formula in Solution	Formula Name Can Be Changed to	Examples of Uses
HF	hydrogen fluoride	HF(aq)	hydrofluoric acid	• Manufacturing aluminum and uranium
HCl	hydrogen chloride	HCl(aq)	hydrochloric acid	• Producing plastic
HBr	hydrogen bromide	HBr(aq)	hydrobromic acid	• Extracting metal ore
HI	hydrogen iodide	HI(aq)	hydroiodic acid	• Taking part in chemical reactions to make other compounds

Table 5.4 Some Acids Containing Oxygen

Formula	Chemical Name	Formula in Solution	Formula Name Can Be Changed to	Examples of Uses
HClO ₄	hydrogen perchlorate	HClO ₄ (aq)	perchloric acid	• Manufacturing explosives and speeding up chemical reactions
HClO ₃	hydrogen chlorate	HClO ₃ (aq)	chloric acid	• Air pollution control
HClO ₂	hydrogen chlorite	HClO ₂ (aq)	chlorous acid	• Disinfectant
HClO	hydrogen hypochlorite	HClO(aq)	hypochlorous acid	• Treating water in swimming pools

Table 5.5 Some Common Bases

Formula	Chemical Name	Common Name	Examples of Uses
NaOH	sodium hydroxide	caustic soda, lye	• Drain and oven cleaner • Used to manufacture paper, glass, and soap
Mg(OH) ₂	magnesium hydroxide	milk of magnesia	• Active ingredient in some antacids
Ca(OH) ₂	calcium hydroxide	hydrated lime	• Soil and water treatment
NH ₄ OH	ammonium hydroxide	household ammonia	• Kitchen cleaner • Used to make fertilizer