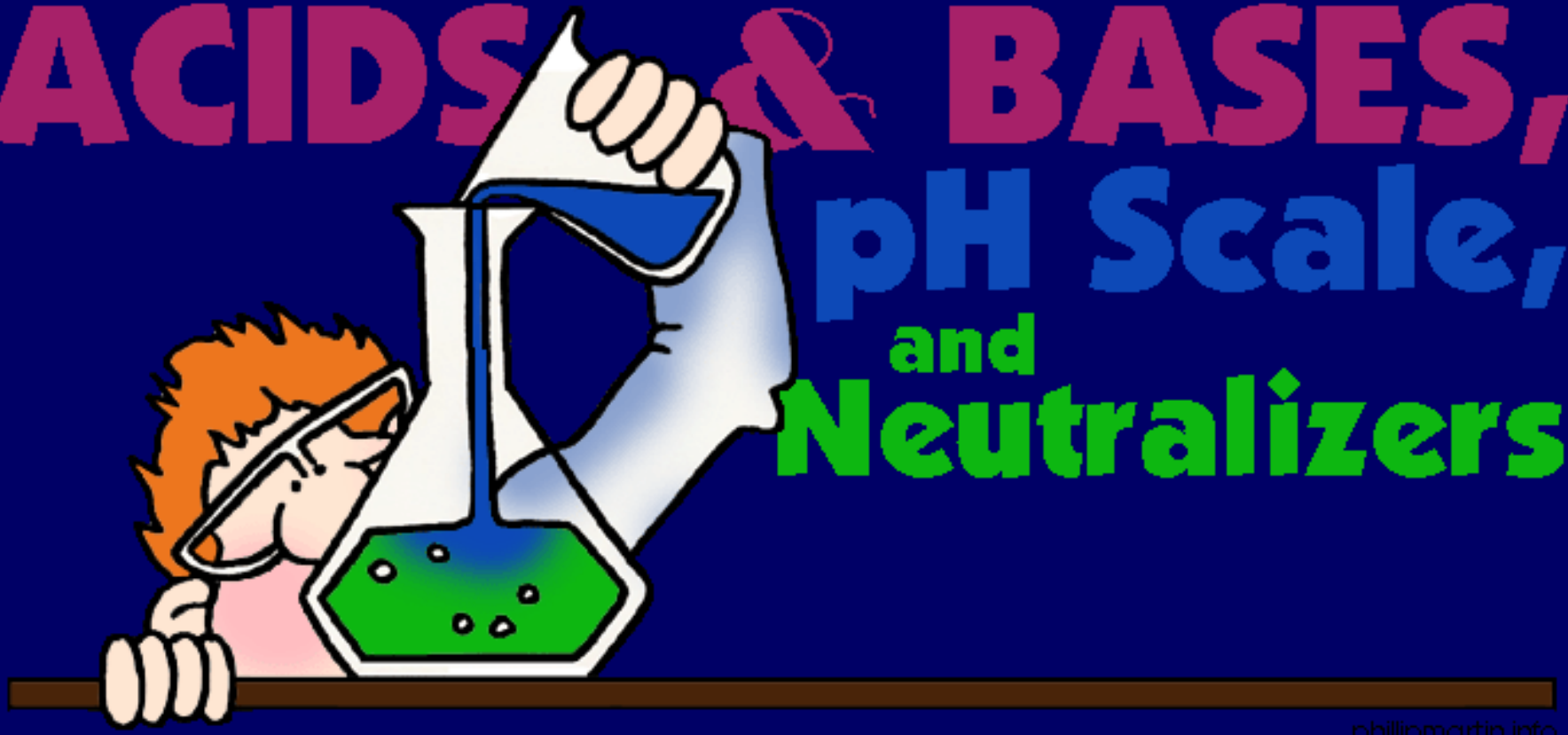
ACIDS & BASES, pH Scale, and Neutralizers



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I Can Statements

At the end of this lesson, you should be able to say, with confidence:

- I can distinguish between an acid and a base according to their pH.
- I can describe common characteristics of acids and bases.
- I describe the role of pH buffers.
- I can describe how litmus paper can be used to determine whether a substance is an acid or base

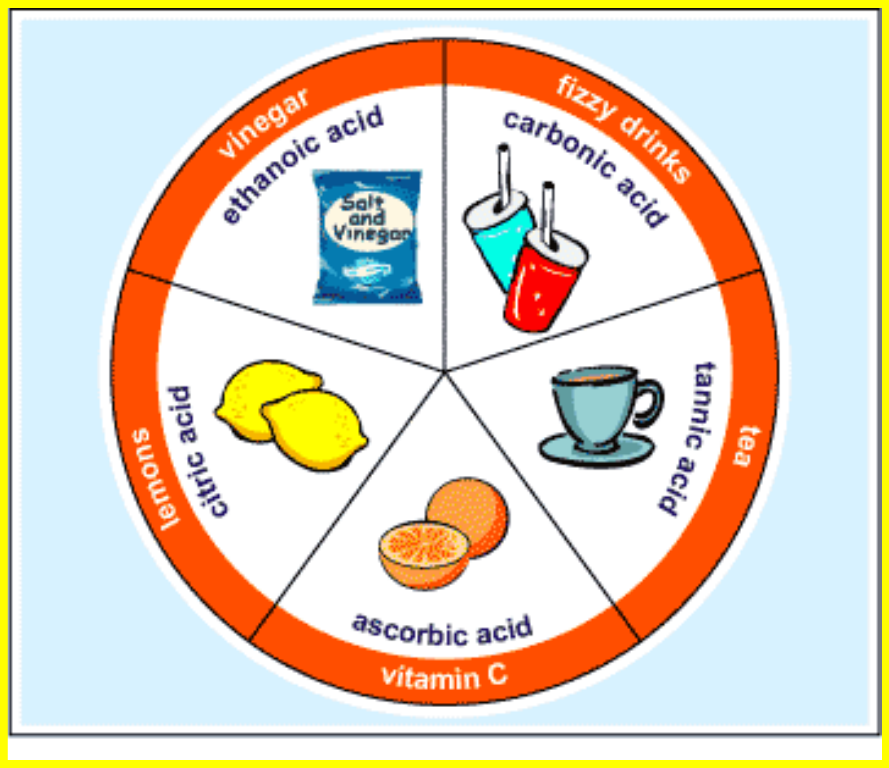
pH

pH is a measurement of how much hydrogen ions, H^+, a substance releases or removes, when dissolved in water.

pH is measured on a scale from 0 - 14

Acids

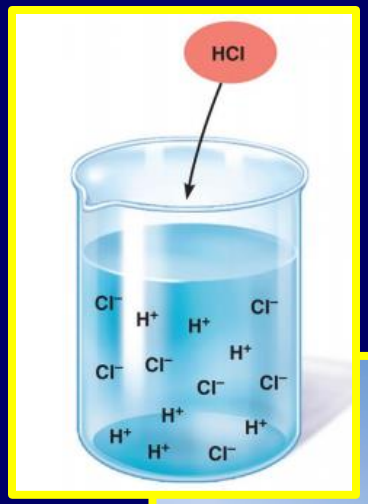
Acids release lots of hydrogen ions (H+) when placed in water and have a pH below 7.



Acids taste sour and can be found in a lot of our foods

Strong Acids

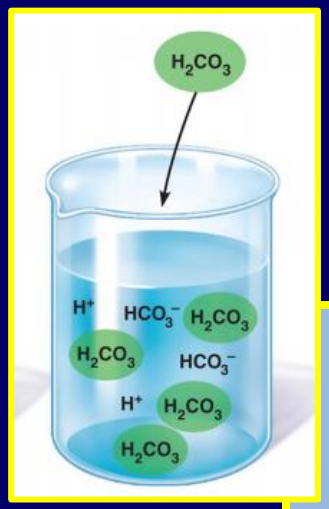
Strong acids completely disassociate into ions, thereby releasing a lot hydrogen ions, H^+, when dissolved in water.



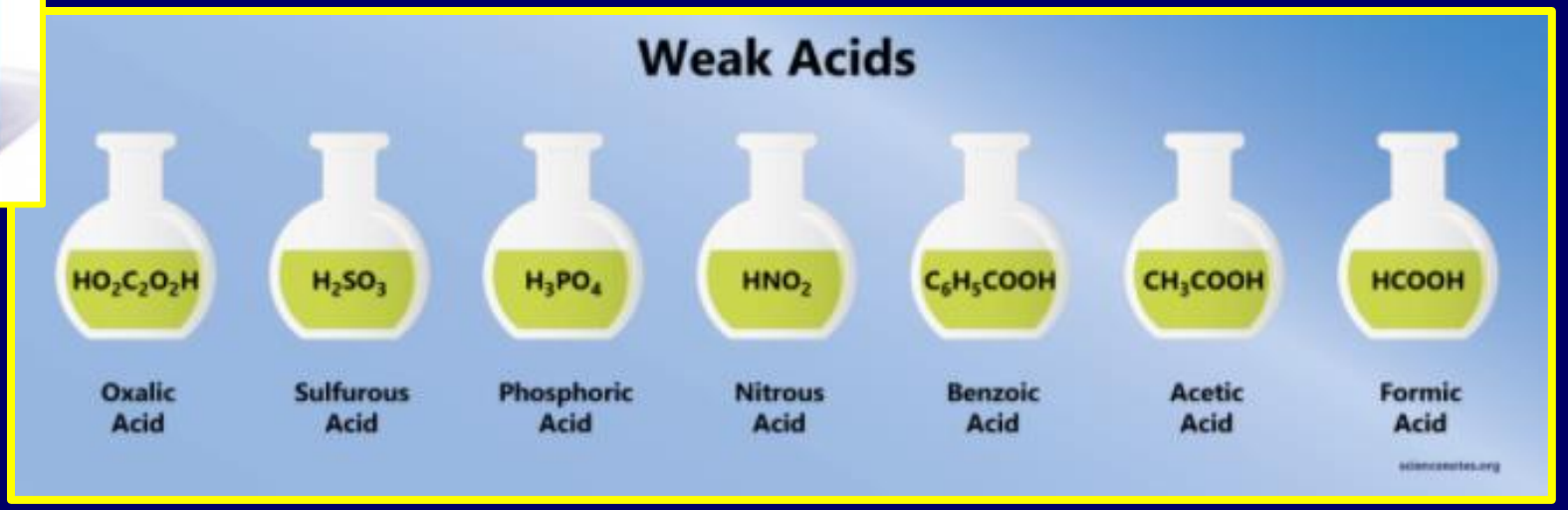
$$HCl \rightarrow H^+ + Cl^-$$

Weak Acids

Weak acids do not completely disassociate into ions, thereby releasing less hydrogen ions, H^+, when dissolved in water.



$$H_2CO_3 \rightarrow H_2CO_3 + H^+ + HCO_3^-$$



pH of Acids

When measuring the pH of acids, we are measuring the amount of hydrogen ions, H^+, that are released when the acid is dissolved in water.

The stronger the acid, the higher the amount of hydrogen ions, H^+, released.

The more hydrogen ions, H^+, released, the lower the pH.

pH of Acids

Strong acids release a lot of hydrogen ions, H^+, so the chances of finding them in a solution of a strong acid and water is very high.

1 in 100 chance of finding H^+

Which can be written as

10^2

So, a pH of 2

pH of Acids

Weak acids release less hydrogen ions, H^+, so the chances of finding them in a solution of a strong acid and water is not as high.

1 in 10,000 chance of finding H^+

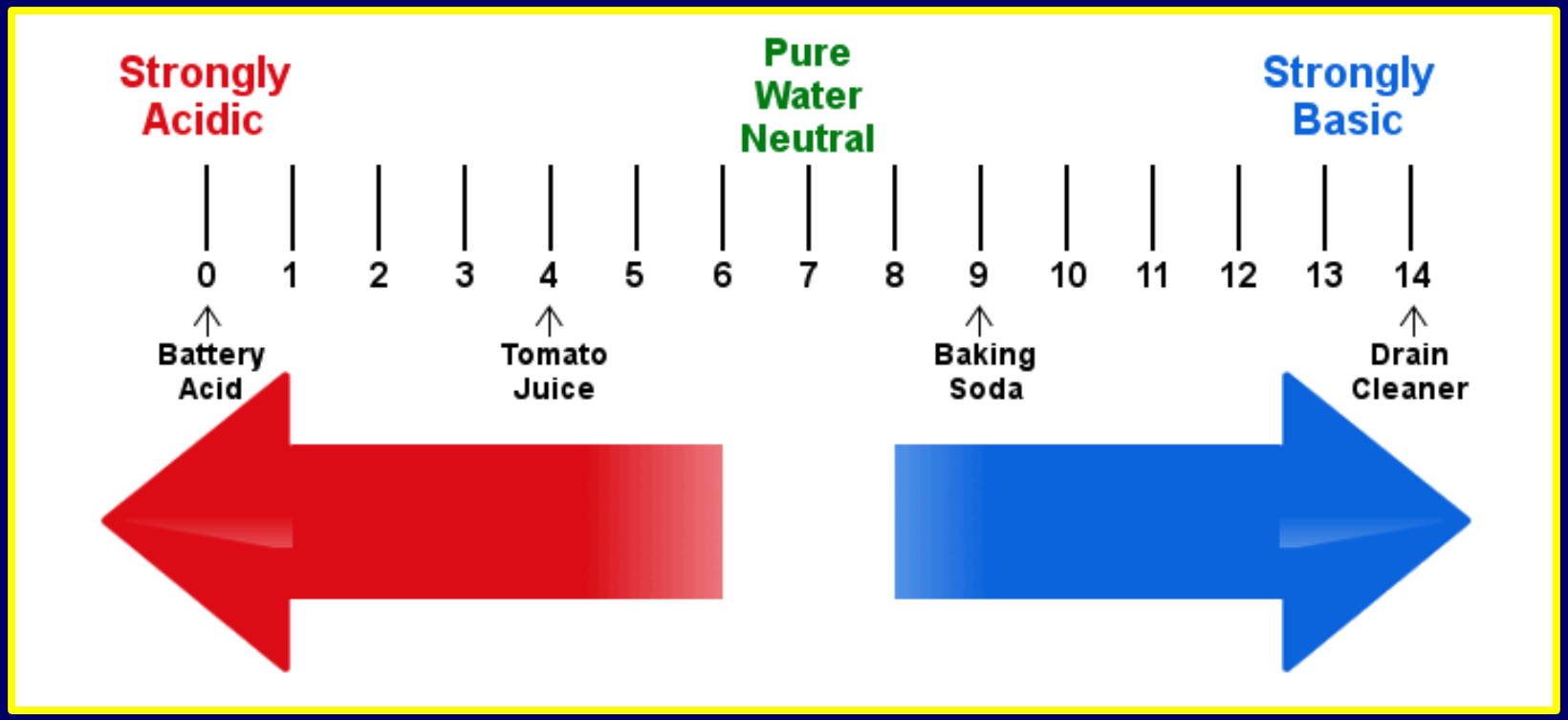
Which can be written as

10^4

So, a pH of 4

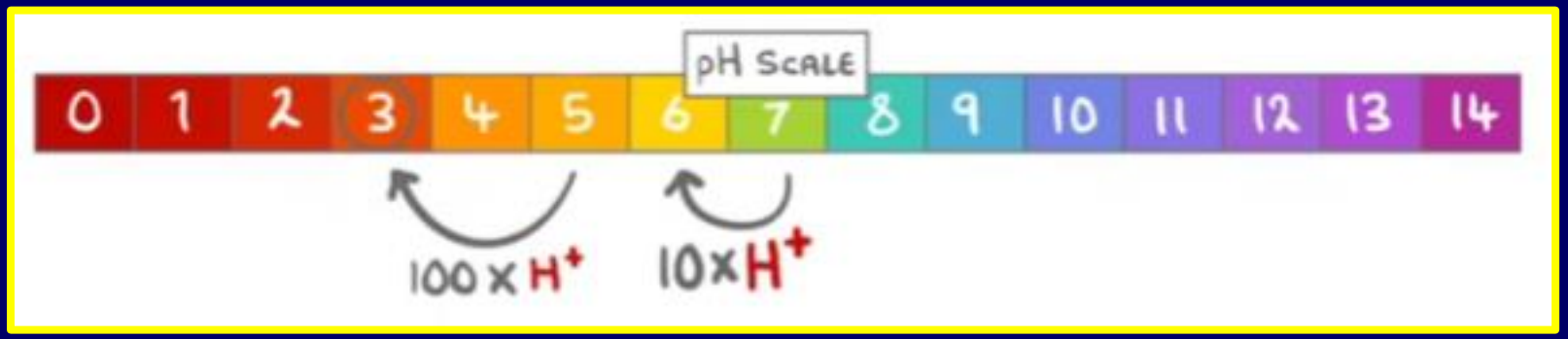
pH of Acids

The stronger the acid, the more hydrogen ions, H^+, released and the lower the pH value.



pH of Acids

On the pH scale, each change in pH represents a change by a factor of 10.



An acid with a pH of 6 is 10 times more acidic than an acid with a pH of 7.

An acid with a pH of 3 is 100 times more acidic than an acid with a pH of 5.

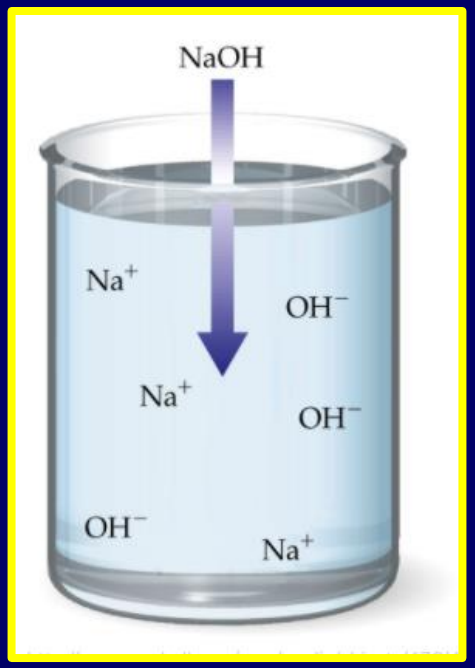
Bases

Bases remove hydrogen ions, H^+, from water molecules, when they are dissolved in water and have a pH above 7.

Bases tend to feel slippery and taste bitter.

Strong Bases

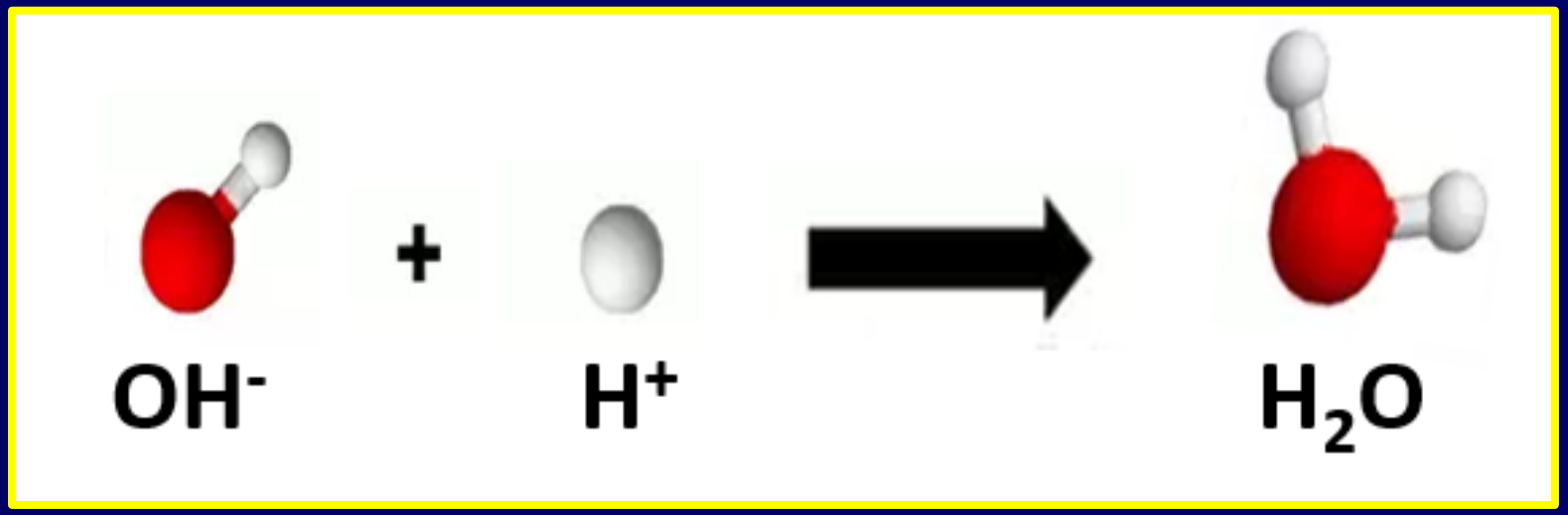
When a strong base, such as sodium hydroxide, NaOH, is dissolved in water, it completely disassociates into sodium ions, Na^+, and hydroxide, OH^-, ions.



$NaOH \rightarrow Na^+ + OH^-$

Strong Bases

Once hydroxide ions, OH^-, are dissolved in water, they are going to bond with any hydrogen ions, H^+, available to form water, H_2O.



pH of Bases

When measuring the pH of bases, we are measuring the amount of hydrogen ions, H^+, that are removed when the based is dissolved in water.

The stronger the base, the higher the amount of hydrogen ions, H^+, removed.

The lower the amount of hydrogen ions, H^+, the higher the pH.

pH of Bases

Strong bases remove lots hydrogen ions, H^+, so the chances of finding them in a solution of a strong base and water is very rare.

1 in 100,000,000,000,000 chance of finding H^+

Which can be written as

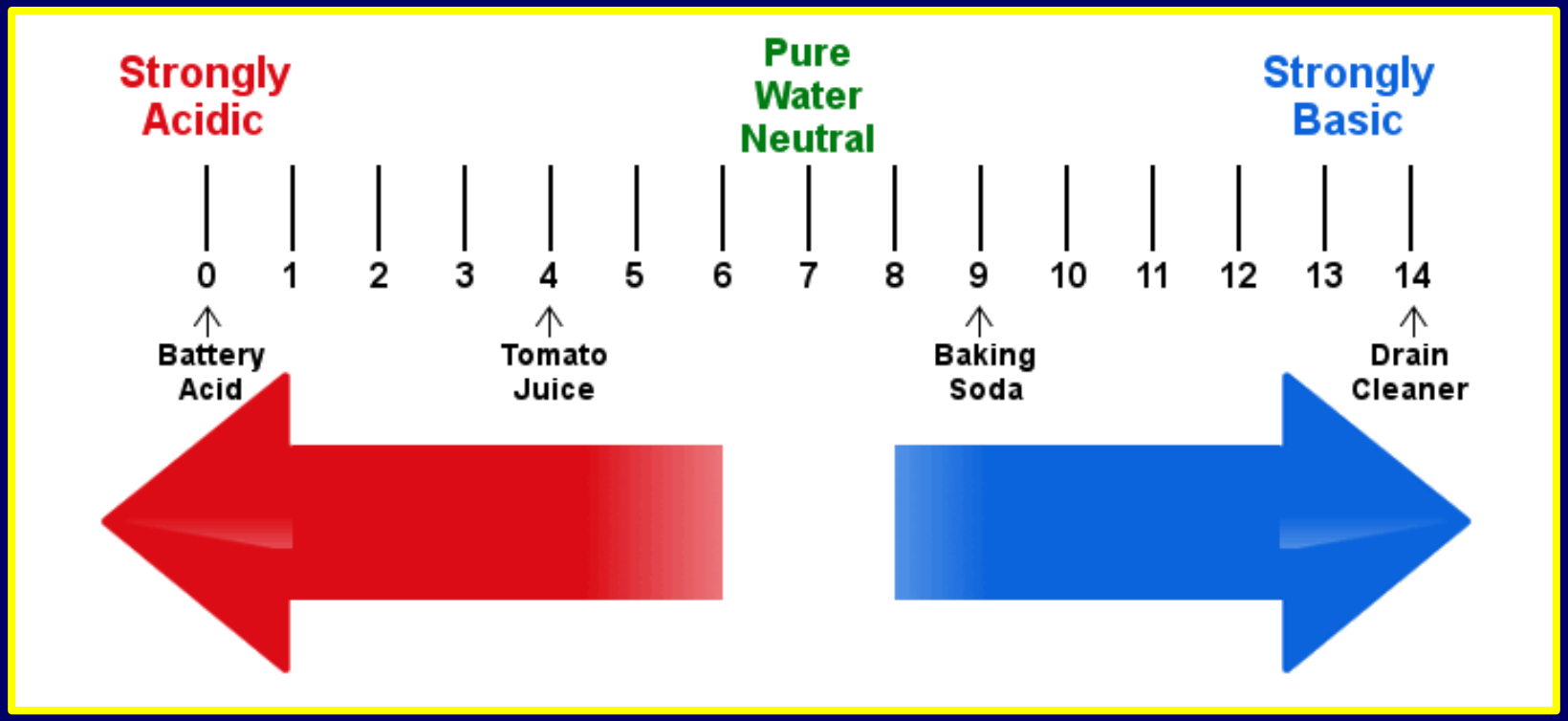
10^{14}

Or

pH = 14

pH of Bases

Bases have a pH value above 7 and the higher the number, the stronger the base.



Corrosive Properties

When a substance is corrosive, it means that it can burn skin.

Burn caused by exposure to wet cement (base pH 10 – 14)

Both strong acids and strong bases are highly corrosive and can burn skin.

Neutral pH

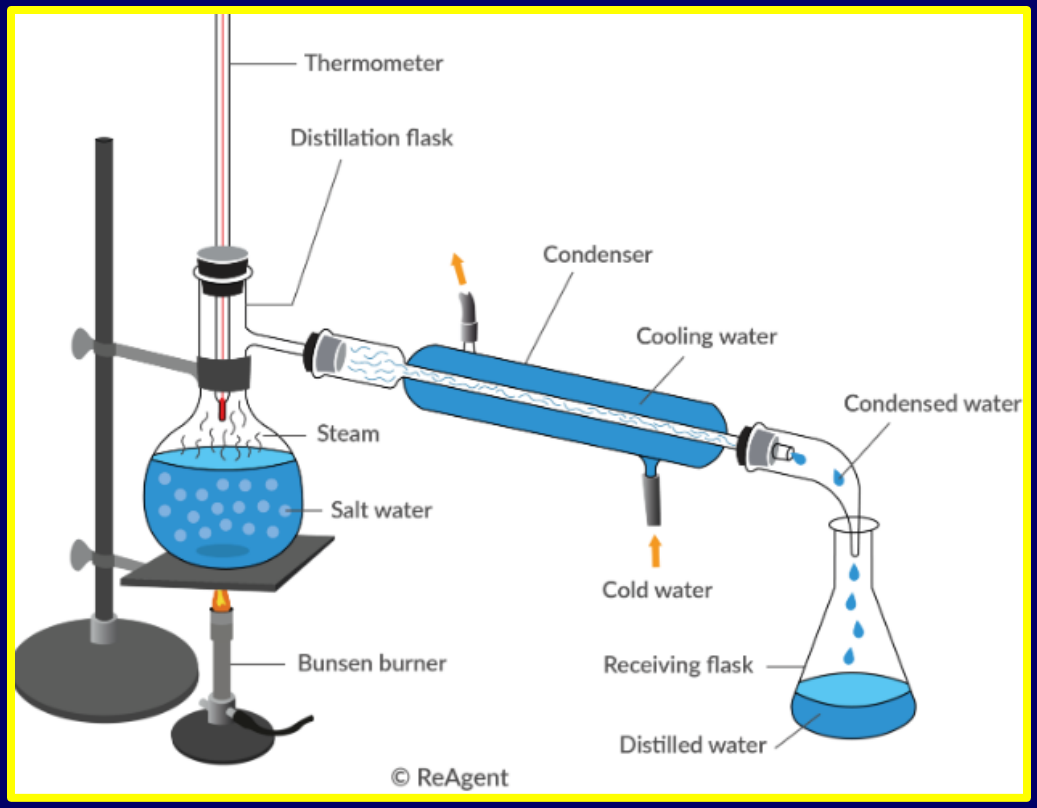
Some substances are not acids or basis and are considered neutral, having a pH of 7.

Pure distilled water has a pH of 7.

Tap water, lake water, and ocean water tend to be slightly acid due to carbonic acid, which is formed when carbon dioxide and water react together.

Distillation

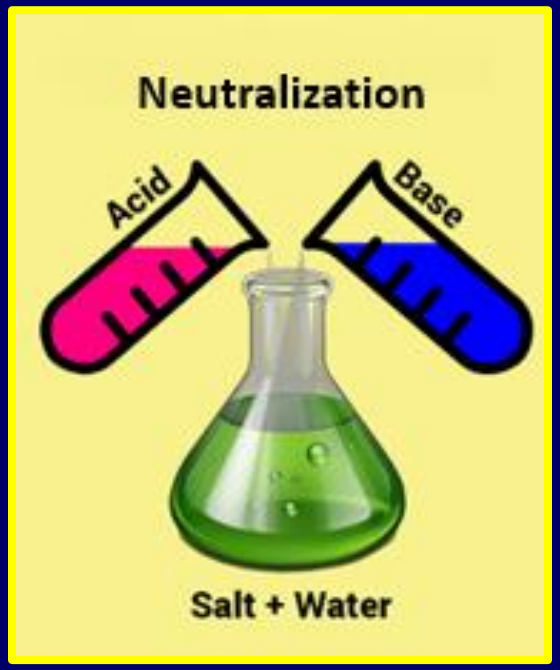
Distilled water is collected by boiling water, capturing the water vapor, and allowing it to condense back into liquid water.



Neutralization

When an acid and a base is combined they neutralize the pH and form salt and water

$$HCL + NaOH \rightarrow H_2O + NaCl$$



pH Buffers

pH buffers are substances that are capable of helping a solution resist large changes in pH.

When our stomach acid becomes too acidic, we can take antacids, which are bases, to help bring back the pH level to where it should be.

Sometimes the buffer may make it more acidic, sometimes it may make it more basic.

Alkalinity

Alkalinity refers to the ability of water to resist becoming more acidic.

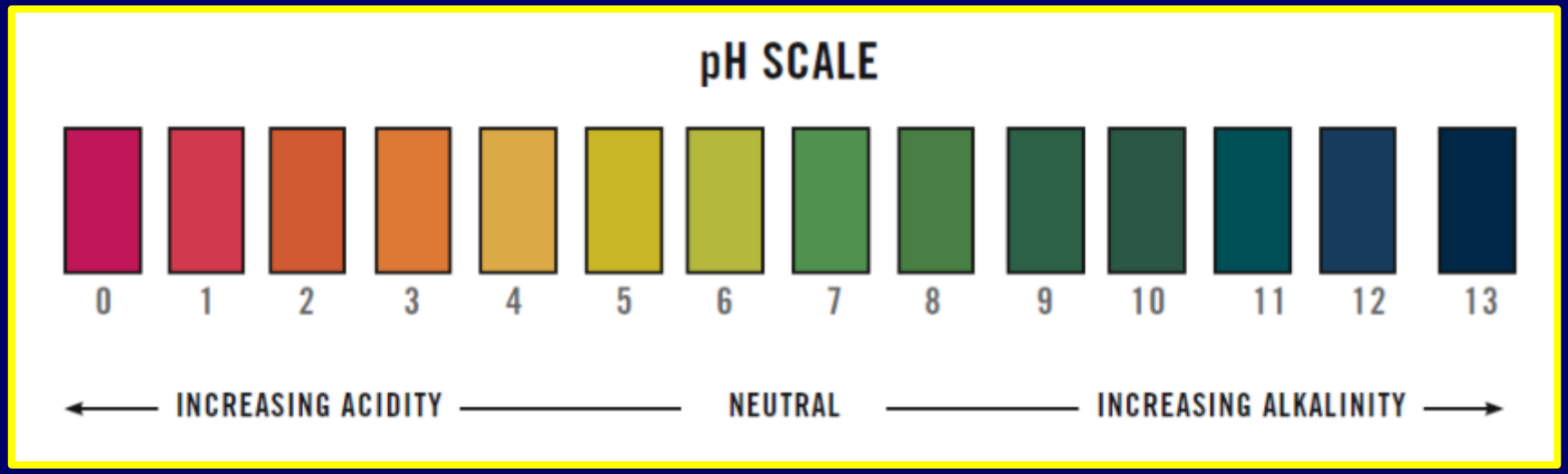
Limestone, $CaCO_3$, when dissolved in water, acts as a buffering agent and increases the water's alkalinity or ability to resist becoming more acidic.

pH Indicators

pH indicators are substances that turn colors when exposed to acid or base solutions

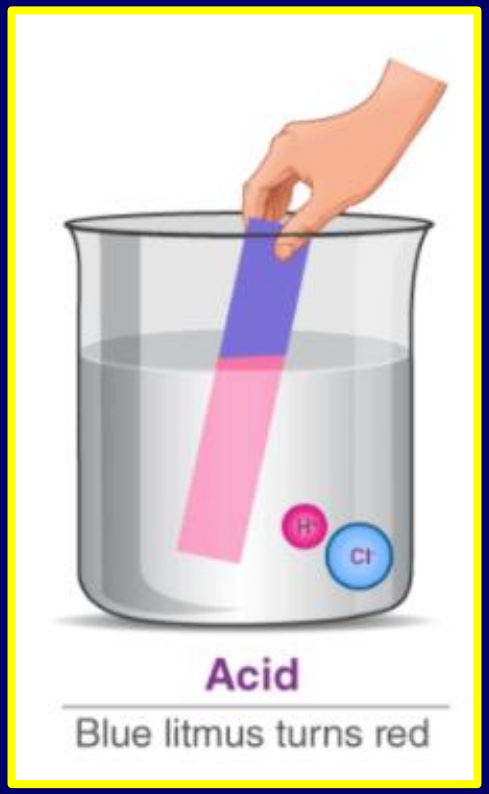
pH Indicators

pH testing strips are created by soaking paper in a chemical that changes to a specific color for each pH value.



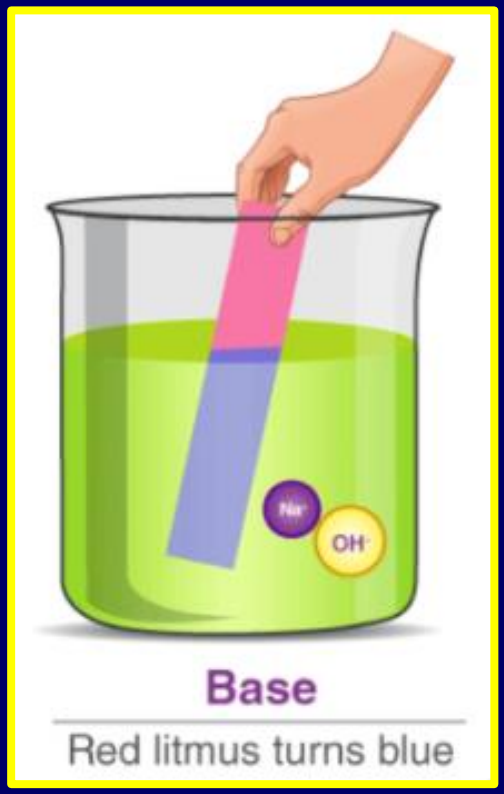
Litmus Paper

Litmus paper tests solutions to find out if they are acids or bases.



Acids turn blue litmus paper red

Bases turn red litmus paper blue



Hydrangea Plants

Hydrangea plants will produce blue flowers in acidic soils and pink flowers in basic soils

The End