Acids and Bases

They are everywhere - In your Food - In your House - And even in you

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Acids

Acids are compounds that produce hydrogen ions (H^{1+}) when dissolved in water
For example when hydrochloric acid is dissolved in water it forms H^{1+} and Cl^{1-} ions

Remember dissolving in water is a physical change.
The higher the concentration of the H^{1+} ions the more acidic is the solution

Some common examples of acids include:

Acetic acid	Vinegar	Hydrochloric acid	Stomach acid
Citric acid	In citrus fruits	Carbonic acid	In soft drinks
Salicylic acid	Aspirin	Sulfuric acid	Battery acid

General Properties of Acids

1	Water soluble
2	Sour in taste
3	Corrosive to skin, fabric and paper
4	Conducts electricity
5	Reacts with metal
6	Turns blue litmus paper red

Naming Acids
Binary acids: acids having hydrogen and one non-metal
Eg: HCl

Step 1: Add the prefix hydro to the beginning
Step 2: Write the name of the non-metal
Step 3: Change the ending to ic acid
HCl - hydrochloric acid

HBr - hydrobromic acid

HI - hydroiodic acid

H_2S - hydrosulfuric acid

Oxy acids: acids having hydrogen and an oxygen containing polyatomic ion
Eg: $HCLO_3$

Step 1: Write the name of the polyatomic ion
Step 2: change the ending of the name

If the name ends in -ate Change the ending to -ic acid

If the name ends in -ite Change the ending to -ous acid

$HClO_3$ Chloric acid

H_2SO_4 Sulfuric acid

HNO_2 Nitrous acid

H_3PO_4 Phosphoric acid

Bases

Bases are compounds that produce hydroxide ions (OH^{1-}) when dissolved in water
For example when sodium hydroxide is dissolved in water it forms Na^{1+} and OH^{1-} ions

$NaOH \rightarrow Na^{1+}_{(aq)} + OH^{1-}_{(aq)}$

The higher the concentration of the OH^{1-} ions the more basic the solution is.

Some common examples of bases include

sodium hydrogen carbonate	Baking soda	aluminum oxide	In antacids
potassium sulfite	Food preservative	sodium hydroxide	In drain & oven cleaners
ammonia	cleaners	potash and lye (KOH and NaOH)	In soap

General Properties of Bases

1	Water soluble
2	Bitter in taste
3	Corrosive to skin, fabric and paper
4	Conducts electricity
5	Feels slippery
6	Turns red litmus paper blue

Neutralization Reactions

A neutralization reaction is a type of double displacment reaction.

A chemical reaction in which an acid and base react with each other to form water and salt is called a neutralization reaction.

A salt is any ionic compound that is created from a neutralization reaction -- (not necessarily NaCl)

HA + BOH → BA + H_2O
Acid + Base → Salt + Water

Examples:

hydrochloric acid + sodium hydroxide → sodium chloride + water
$HCl + NaOH \rightarrow NaCl + H_2O$

sulfuric acid + magnesium hydroxide → magnesium sulfate + water
$H_2SO_4 + Mg(OH)_2 \rightarrow MgSO_4 + 2H_2O$

nitrous acid + calcium hydroxide → calcium nitrite + water
$2HNO_2 + Ca(OH)_2 \rightarrow Ca(NO_2)_2 + 2H_2O$

Practice Writing Chemical Equations for Neutralization Reactions

Write word equations and balanced chemical equations for the following neutralization reactions:

1. Aluminum hydroxide reacts with nitric acid.
   nitric acid + aluminum hydroxide → aluminum nitrate + water
   $3HNO_3 + Al(OH)_3 \rightarrow Al(NO_3)_3 + 3H_2O$

2. Aqueous hydrofluoric acid reacts with potassium hydroxide.
   hydrofluoric acid + potassium hydroxide → potassium fluoride + water
   $HF + KOH \rightarrow KF + H_2O$

3. Lithium hydroxide reacts with phosphoric acid.
   phosphoric acid + lithium hydroxide → lithium phosphate + water
   $H_3PO_4 + 3LiOH \rightarrow Li_3PO_4 + 3H_2O$

4. Barium hydroxide reacts with hydroiodic acid.
   hydroiodic acid + barium hydroxide → barium iodide + water
   $HI + Ba(OH)_2 \rightarrow BaI_2 + H_2O$

pH

The term pH was first used in _1909_ by _Soren Peter Lauritz Sorensen_

He did not mention what the little p stood for, obviously H was for _hydrogen_

Today the accepted full form is _power of hydrogen_

pH is a _numerical scale_ that ranges from _0 to 14_

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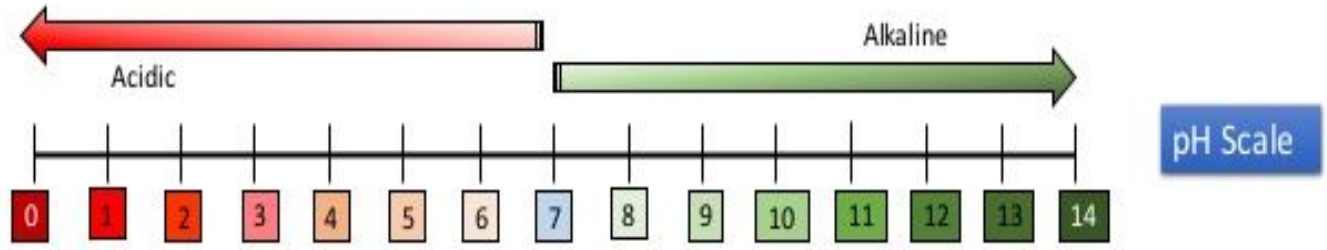
The pH scale measures how _acidic or basic_ a substance is.

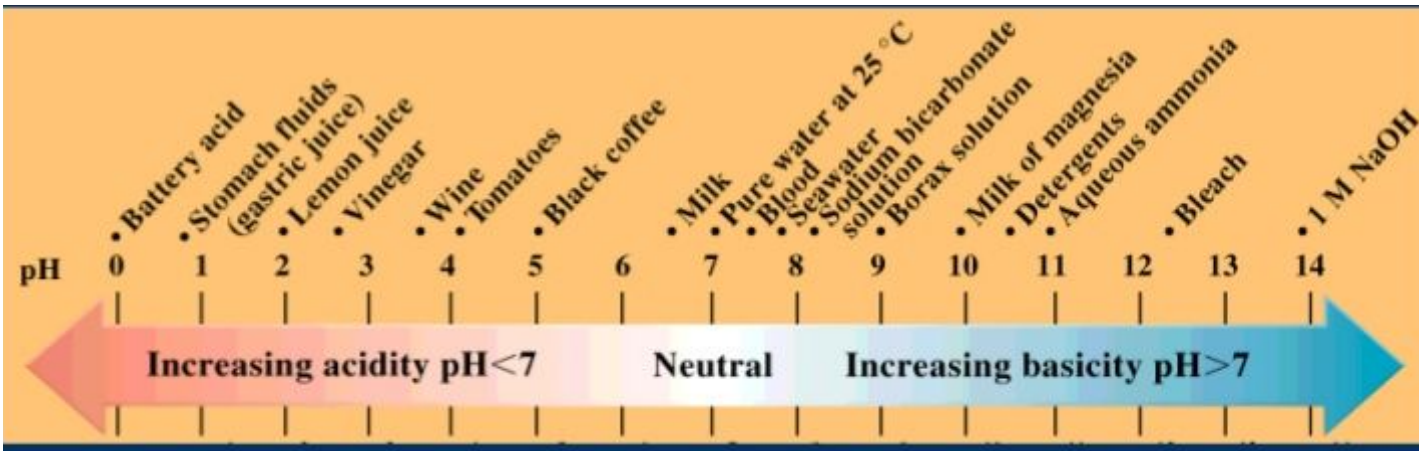
A pH of _7 is neutral_

A pH _less than 7 is acidic_. Lower values indicate _a stronger acid_

A pH _greatr than 7 is basic_. Higher values indicate _a stronger base_



pH of some common household materials



The pH scale is _logarithmic_ and as a result each whole pH value below 7 is _10 times_ more acidic than the next higher value

For example, pH 4 is _10 times more acidic_ than pH 5 and _100 times more_ acidic than pH 6

The same holds true for pH values above 7, each of which is _10 times more alkaline (basic)_ than the next lower whole value

For example, pH 10 is 10 times more basic than pH 9 and 100 times more basic than pH 8

A pH of 3 is _10 times more acidic_ than a pH of 4

A pH of 3 is _100 times more acidic_ than a pH of 5

A pH of 11 is _1000 times more basic_ than a pH of 8

A pH of 10 is _100 times less basic_ than a pH of 12

pH Indicators

Determining the pH of a Solution

Litmus Paper

	Acid	**Neutral**	**Base**
Red Litmus Paper	stays red	stays red	turns blue
Blue Litmus Paper	turns red	stays blue	stays blue

Other pH Indicators

Indicator	**pH Range in which colour change occurs**	**Colour changes as pH increases**
Methyl Orange	3.2 - 4.4	from red to yellow
Methyl Red	4.8 – 6.0	from red to yellow
Bromothymol Blue	6.0 – 7.6	from yellow to blue
Phenophthalein	8.2 – 10.0	from clear (colourless) to pink
Indigo Carmine	11.2 – 13.0	from blue to yellow

See page 233 in your text