EQUILIBRIUM

PART- II

- ACIDS
  - Defination
  - Basicity of an acid
  - Classification of acids
- BASES
  - Defination
  - Acidity of base
  - Classification of bases
- ALKALI
- NEUTRALISATION
- SALTS

ACIDS USED IN DAILY LIFE.

- Milk contains lactic acid.

- Carbonic acid is responsible for the fizz in soft drinks.

- Ascorbic acid is the chemical name of vitamin –C.

- Vinegar used in cooking contains approximately 4 % acetic acid.

- Sulphuric acid is used in the manufacture of car batteries.

Hydrochloric Acid

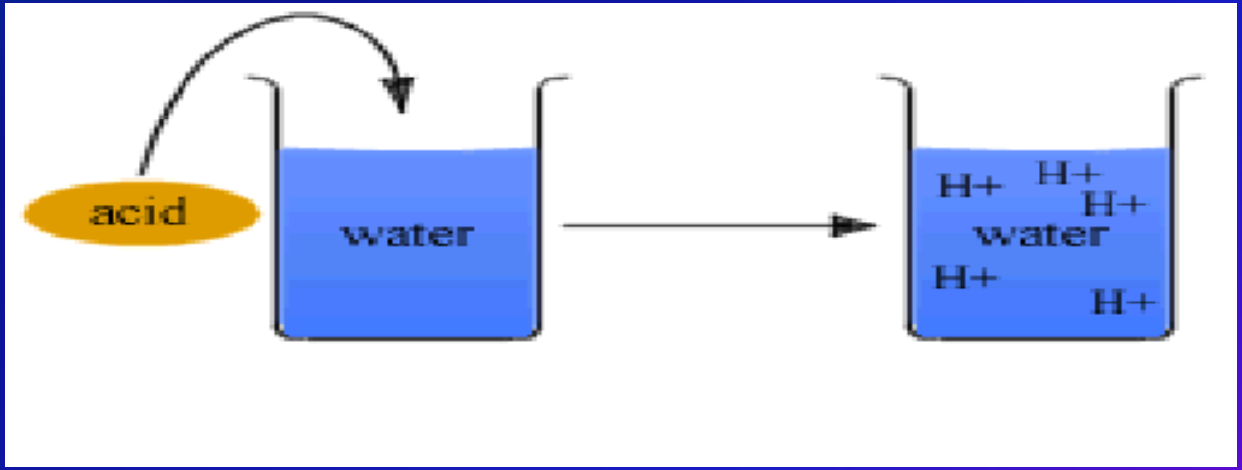
C. Ophardt, c. 2003

Toilet cleaner

What is an acid?

ACIDS

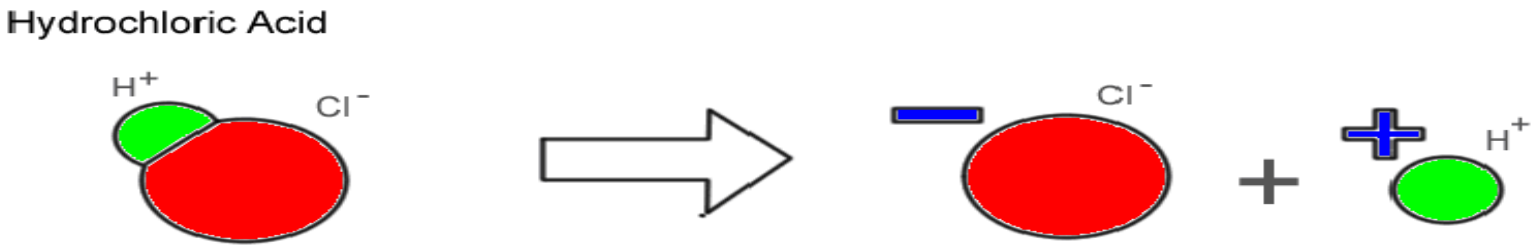
An acid is a substance which contains one or more replaceable hydrogen atoms and dissociates in solution giving hydrogen ions(H^+).



Ex : $2\,HCl + 2\,Na \rightarrow 2NaCl + H_2$

one molecule of HCl contains one replaceable hydrogen atom.

$$HCl_{(aq)} \rightarrow H^+ + Cl^-$$



- $H_2SO_{4\,(aq)} + Zn \rightarrow ZnSO_4 + H_2$

  one molecule of H_2SO_4 contains two replaceable hydrogen atoms.

- $H_2SO_{4\,(aq)} \rightarrow 2\,H^+ + SO_4^{2-}$

- $HNO_{3\,(aq)} \rightarrow H^+ + NO_3^-$

- $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 + H_2O$

  one molecule of CH_3COOH contains one replaceable hydrogen atom.

- $CH_3COOH_{(aq)} \rightarrow H^+ + CH_3COO^-$

Mineral acids and organic acids.

- A **mineral acid** (or **inorganic acid**) is an acid derived from one or more inorganic compounds.

- All mineral acids form hydrogen ions when dissolved in water.

  Ex: HCl , HNO_3 H_2SO_4 etc

Organic compounds having acidic property are organic acids.

Ex: Carboxylic acids

$HCOOH$

CH_3COOH

C_6H_5COOH

BASICITY OF AN ACID

It is the number of replaceable hydrogen atoms present in a molecule of an acid.

CLASSIFICATION OF ACIDS :

Depending on the basicity of the acids, they are classified as:

- Monobasic acid
- Dibasic acid
- Tribasic acid etc.

MONOBASIC ACID

Monobasic acid contains one replaceable hydrogen atom in a molecule.

Ex :

Hydrochloric acid - HCl

Nitric acid - HNO_3

For organic acids basicity is the number of -COOH groups present in the molecule.

Ex :

HCOOH

CH_3COOH

C_6H_5COOH

DIBASIC ACID

Dibasic acid contains two replaceable hydrogen atoms in a molecule.

Ex :

Sulphuric acid - H_2SO_4

Oxalic acid - $C_2H_2O_4$

($HOOC - COOH$)

TRIBASIC ACID

A tribasic acid contains three replaceable hydrogen atoms in a molecule.

Ex :

Orthophosphoric acid - H_3PO_4

- Almost all inorganic acids are soluble in water.
- For volumetric analysis, solution of acids having different concentrations are prepared.
- Concentration of acids are expressed in normality or molarity.

Why SO_3 , BF_3 etc are acids?

BASES USED IN DAILY LIFE.

Antacids help to neutralize the acidity in the stomach.

They mainly contain two bases:

- $Mg(OH)_2$

&

- $Al(OH)_3$

Potassium hydroxide is used in the manufacture of alkaline batteries.

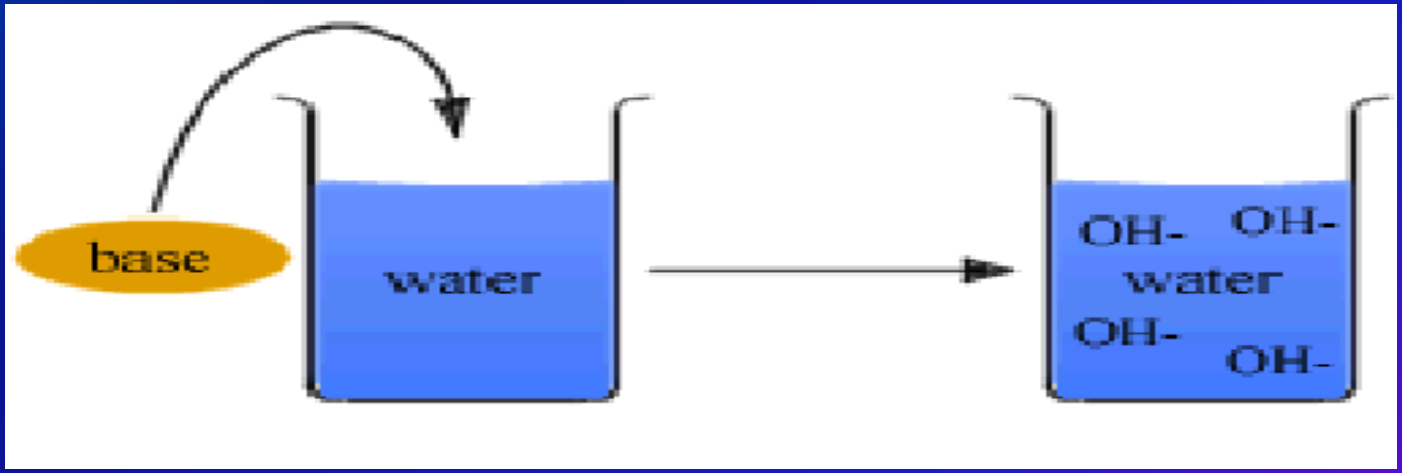
Ammonia is a basic gas which is used in the manufacture of fertilizers such as :

- urea
- ammonium nitrate
- ammonium phosphate.

What is a base?

BASES

- A base is a substance which dissociates in solution giving hydroxyl (OH^-) ions.

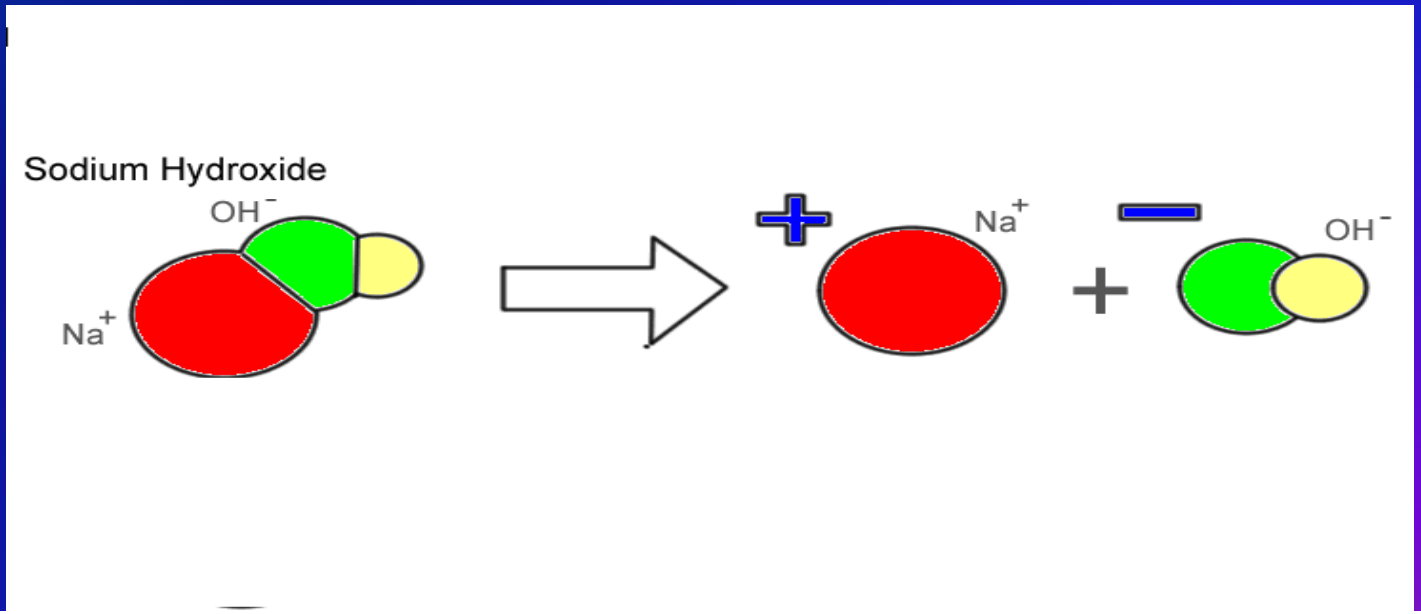


The oxides and hydroxides of metals are bases or basic in nature.

Ex : Sodium hydroxide (NaOH)is a base.

NaOH dissociates in solution

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



- Calcium hydroxide $Ca(OH)_2$ is a base

  $Ca(OH)_2$ dissociates in solution.

  $Ca(OH)_2 \rightarrow Ca^{2+} + 2\ OH^-$

- Aluminium hydroxide $Al(OH)_3$ is a base

  $Al(OH)_3$ dissociates in solution.

  $Al(OH)_3 \rightarrow Al^{3+} + 3\ OH^-$

ACIDITY OF BASE

It is the number of molecules of monobasic acid required to neutralize one molecule of a base.

Ex : $NaOH + HCl \rightarrow NaCl + H_2O$

Acidity of NaOH is one

or

NaOH is **monoacidic base**.

$$Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$$

Acidity of $Ca(OH)_2$ is two

or

$Ca(OH)_2$ is **diacidic base**.

$$Al(OH)_3 + 3HCl \rightarrow AlCl_3 + 3H_2O$$

Acidity of $Al(OH)_3$ is three

or

$Al(OH)_3$ is **triacidic base**.

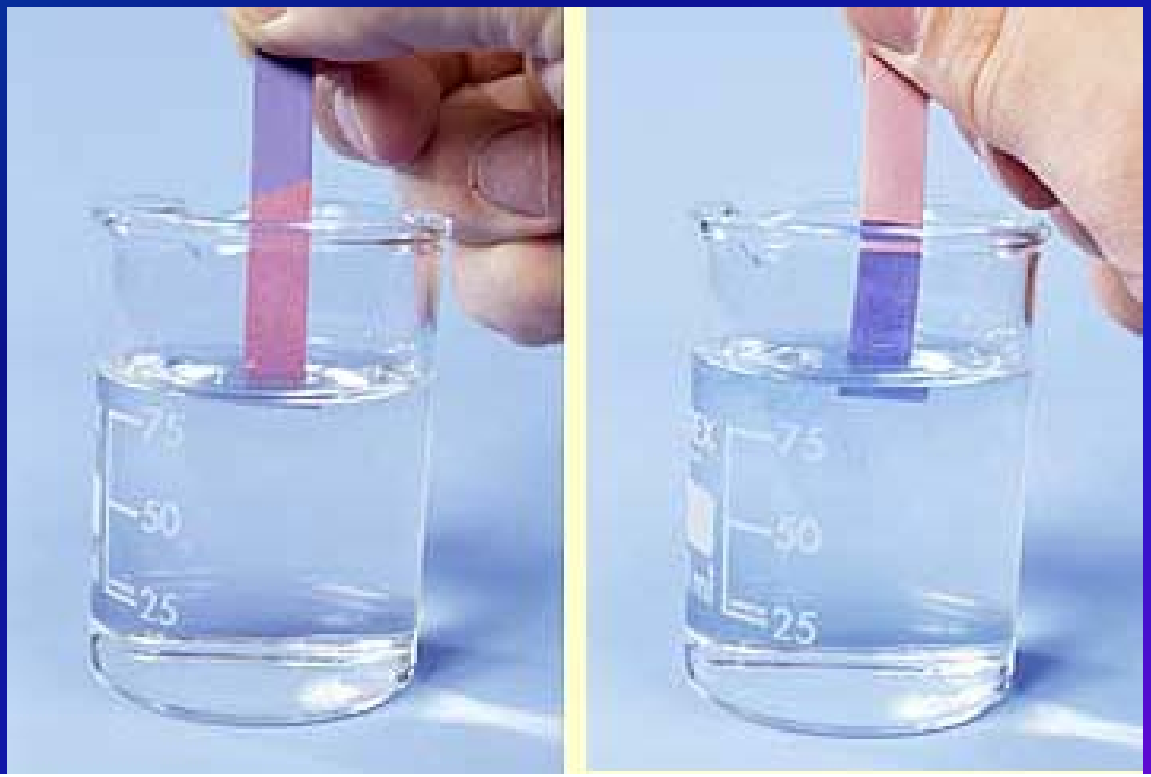
ACIDITY OF BASE

Acidity of hydroxide is the number of hydroxyl (OH) groups present in a molecule of it.

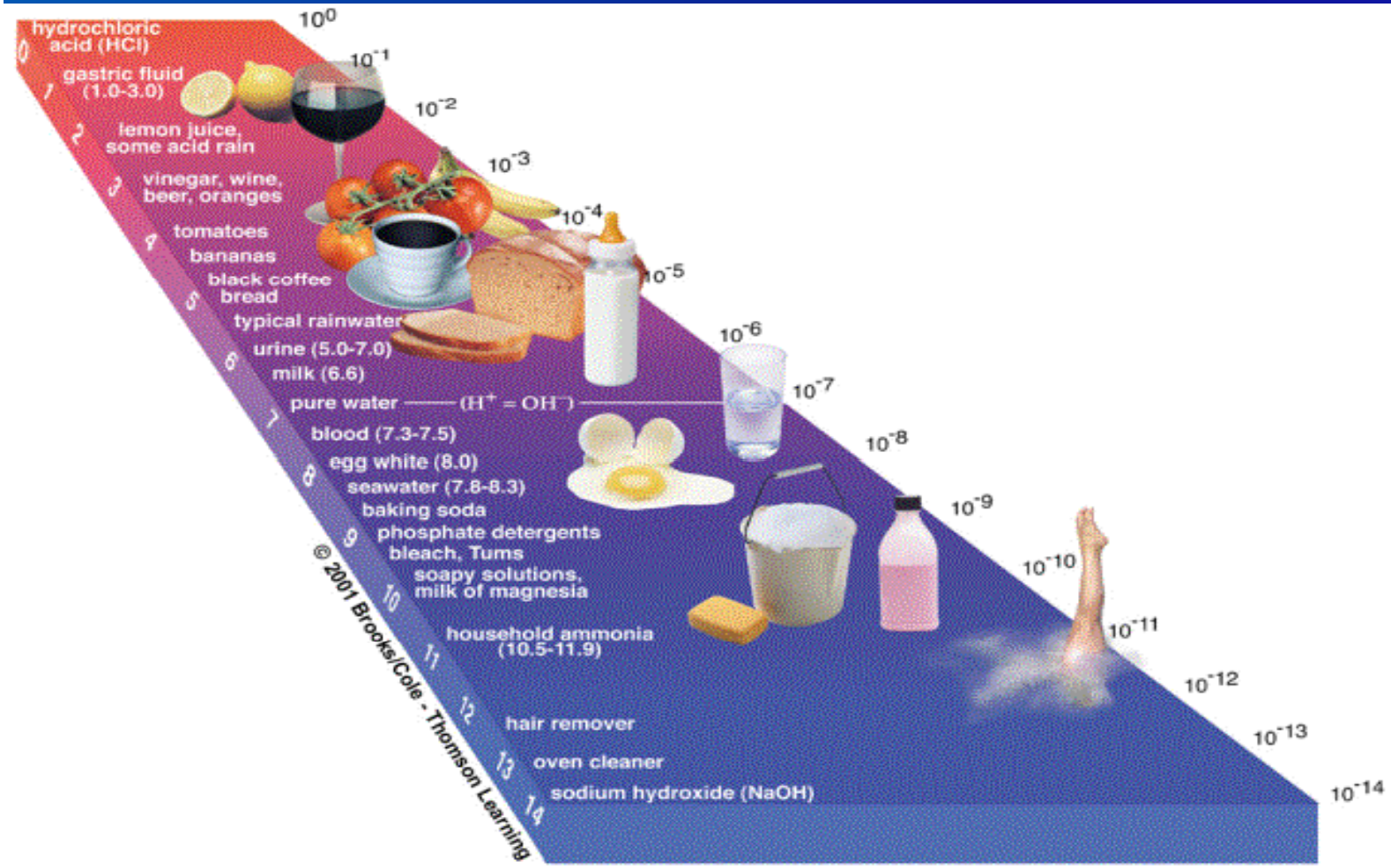
Base	Acidity
$NaOH$	1
$Ca(OH)_2$	2
$Al(OH)_3$	3

How to detect the acids & bases?

- Acids turns blue litmus to red.
- Bases turns red litmus to blue.



Why CaO ,MgO are bases?


hydrochloric acid (HCl)
gastric fluid (1.0-3.0)
lemon juice, some acid rain
vinegar, wine, beer, oranges
tomatoes
bananas
black coffee
bread
typical rainwater
urine (5.0-7.0)
milk (6.6)
pure water
$(H^+ = OH^-)$
blood (7.3-7.5)
egg white (8.0)
seawater (7.8-8.3)
baking soda
phosphate detergents
bleach, Tums
soapy solutions, milk of magnesia
household ammonia (10.5-11.9)
hair remover
oven cleaner
sodium hydroxide (NaOH)
0
1
2
3
4
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6
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14
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ALKALI

The bases which are readily soluble in water are called alkali.

- Oxides and hydroxides of “group - 1 ” metals of long form of periodic table are readily soluble in water. They are called alkalies.

- These metals are called alkali metals.

Ex:

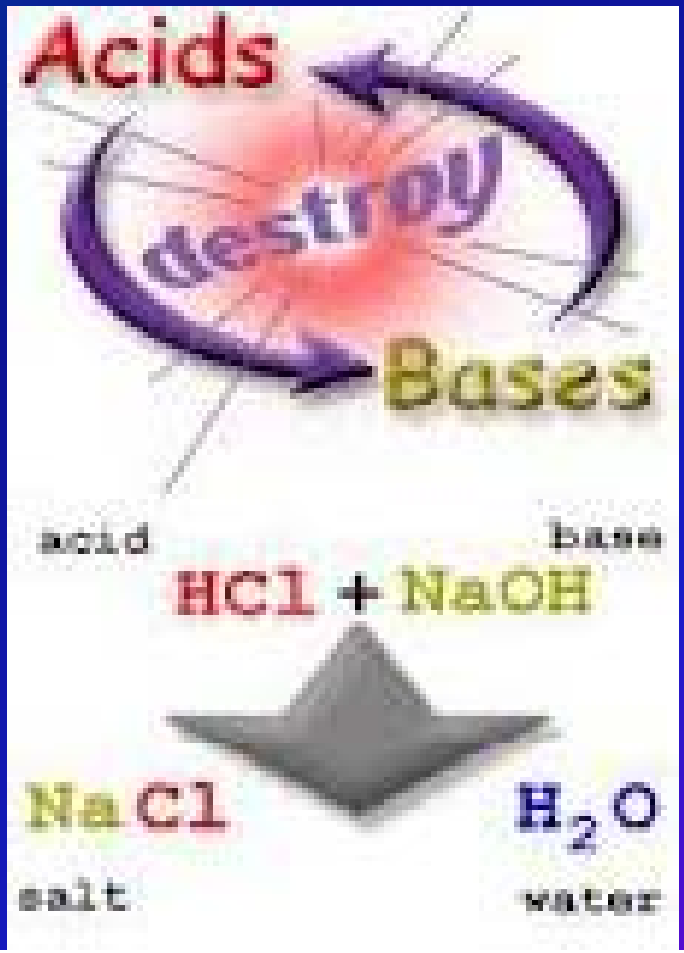
- NaOH is a base and also an alkali.
- KOH is a base and also an alkali.
- $Mg(OH)_2$, $Ca(OH)_2$ are bases only but not alkalies.

All the alkalies are bases but all the bases are not alkalies.

NEUTRALISATION

The reaction between an acid and a base in dilute aqueous solution is called neutralisation reaction.

Ex: $HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O$



$$H_2SO_{4(aq)} + 2NaOH_{(aq)} \rightarrow Na_2SO_{4\,(aq)} + 2H_2O$$

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

What are salts?

SALT

The Chemical substance obtained as a result of neutralisation reaction between an acid and a base is called salt.

Ex: $HCl_{(aq)} + NaOH_{(aq)} \rightarrow \mathbf{NaCl}_{(aq)} + H_2O$

- $H_2SO_{4\,(aq)} + 2NaOH_{(aq)} \rightarrow \mathbf{Na_2SO_{4(aq)}} + 2H_2O$
- $HNO_{3\,(aq)} + NaOH_{(aq)} \rightarrow \mathbf{NaNO_{3(aq)}} + H_2O$
- $HCl_{(aq)} + KOH_{(aq)} \rightarrow \mathbf{KCl_{(aq)}} + H_2O$
- $HNO_{3\,(aq)} + KOH_{(aq)} \rightarrow \mathbf{KNO_{3(aq)}} + H_2O$

THANK YOU