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Prep Smart. Score Better.

Acids Bases and Salts

“The Pessimist Sees Difficulty In Every Opportunity.
The Optimist Sees Opportunity In Every Difficulty.”

– Winston Churchill

Acids –

→Taste = sour

→Blue litmus ------- Red

→Aqueous solution conducts electricity.

→Gives H^+ ions when dissolved in water.

E.g., HCl ---------- H^+ + Cl

❑ **Types-**

1) **Organic acids**

2) **Mineral acids.**

❑ **Organic acids –** **Naturally occurring acids .**

e.g.,

Formic acid = Ant sting +Bee sting + Scorpion sting
Acetic acid = Vinegar
Lactic acid = Curd.
Citric acid = Lemon
Ascorbic acid = Citrus fruits
Malic acid = Apple
Oxalic acid = Tomato + Spinach
Tartaric acid = Tamarind+ Grapes
Sulfenic acid = Onion
Glutamic acid = Wheat
Nucleic acid = DNA/RNA
Amino acid = Protein

❖ **Mineral acids**

Made in lab by minerals.

e.g., Sulphuric acid

Nitric acid

Hydrochloric acid

Weak acids –

Provide less amount of hydrogen ions when dissolved in water.

e.g., All organic acids.

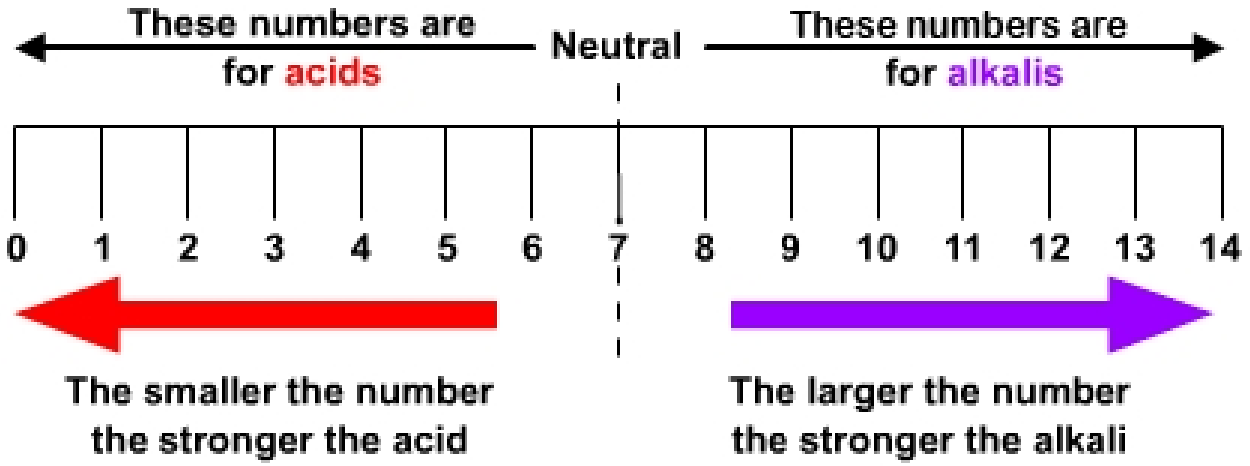
Strong acids –

Provide large amount of hydrogen ions when dissolved in water

E.g., Mineral acids.

p H – scale.

By = Sorenson.



Aqua Regia

$HCl + HNO_3$

3 : 1

Uses :

Used to dissolve metals.

Used by Goldsmith.

Acid Rain

↓

Factory Exhaust

↙ ↘

SO_2 + NO_2

H_2O

H_2SO_4 + HNO_3

With Rain Water

↓

Acid Rain

→PH of acid Rain = less than 5.6

→Stone leprosy = Due to acid Rain

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Harmful Effects of Acid Rain

1. Acid rain is very harmful to agriculture, plants, and animals. It washes away all nutrients which are required for the growth and survival of plants

2. It causes respiratory issues in animals and humans

3. When acid rain falls down and flows into the rivers and ponds it affects the aquatic life

4. It damages the buildings and monuments made up of stones and metals

Real-Life Examples

Taj Mahal, one of the 7 wonders of the world, is largely affected by acid rain. The city of Agra has many industries which emit the oxides of sulphur and nitrogen in the atmosphere. Acid rain has the following reaction with the marble (calcium carbonate):

$$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$$

The formation of calcium sulphate results in the corrosion of this beautiful monument

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Effect of acid rain

Taj Mahal color due to acid rain. Acid rain reacted with the marble (calcium carbonate) of Taj Mahal. This caused damage to this wonderful structure, ...

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Statue of Liberty which is made of copper has also been damaged by the cumulative action of acid rain & oxidation for over 30 years and is, therefore, becoming green in colour

❑ **Bases –**

Taste = Bitter

Red litmus ----- Blue

Aqueous solution conducts electricity.

Gives OH^- when dissolved in water.

E.g., $NaOH \text{ ---------- } Na^+ + OH^-$.

Types –

1. **Strong base –**

Provides large amount of OH^- when dissolved in water.
e.g., NaOH, KOH etc.

2. Weak base –

Provides small amount of H^+ when dissolved in water.
e.g., $Ca(OH)_2$, $Mg(OH)_2$ etc.

Alkali – Water soluble bases are called alkalies.

Neutralization reaction.

Acid + Bases ---------- Salt + Water.

$HCl + NaoH \text{ ---------- } NaCl + H_2O.$

↓

Common salt or table salt.

Types of Salts-

(i) Neutral salt

(ii) Acidic salt

(iii) Basic salt.

Acid	Base	Salt	Example
Strong	Strong	Neutral	$NaOH + HCl \rightarrow NaCl + H_2O$
Strong	Weak	Acidic	$HCl + NH_4OH \rightarrow NH_4Cl + H_2O$
Weak	Strong	Basic	$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$
Weak	Weak	Neutral	$CH_3COOH + NH_4OH \rightarrow CH_3COONH_4 + H_2O$

Applications –

1. Acidity + Antacids ------→ Salt + Water

↓ ↓

HCl Weak base

e.g. → Milk of magnesia

→ Digene

→ Baking Soda etc.


Too much acid
produced in stomach
Antacid
Take basic substance
to destroy acid

Mouth

↓

2. Sugar ----------> Acid (pH less than 5) + Paste --------> Salt +Water

↓ ↓ ↓ ↓

Bacteria **Destroy** **(Base)** **No Cavity**

↓

Enamel

↓

Cavity

3. Ant Sting + Apply Calamine Solution ----------→ Salt + Water

↓ ↓

Formic Acid [$NaHCO_3 + H_2O$]

Chemical fertiliser

↓

4. Soil ----------> Acidic + Slaked lime --------> Salt + Water

↓

$Ca(OH)_2$

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Definition of Acids / Bases-

Arrhenius Concept –

Acid is a substance that dissociates in water to form hydrogen ions (H^+).
An Arrhenius base is a substance that dissociates in water to form hydroxide (OH^-) ions

Bronsted- Lowry Concept -

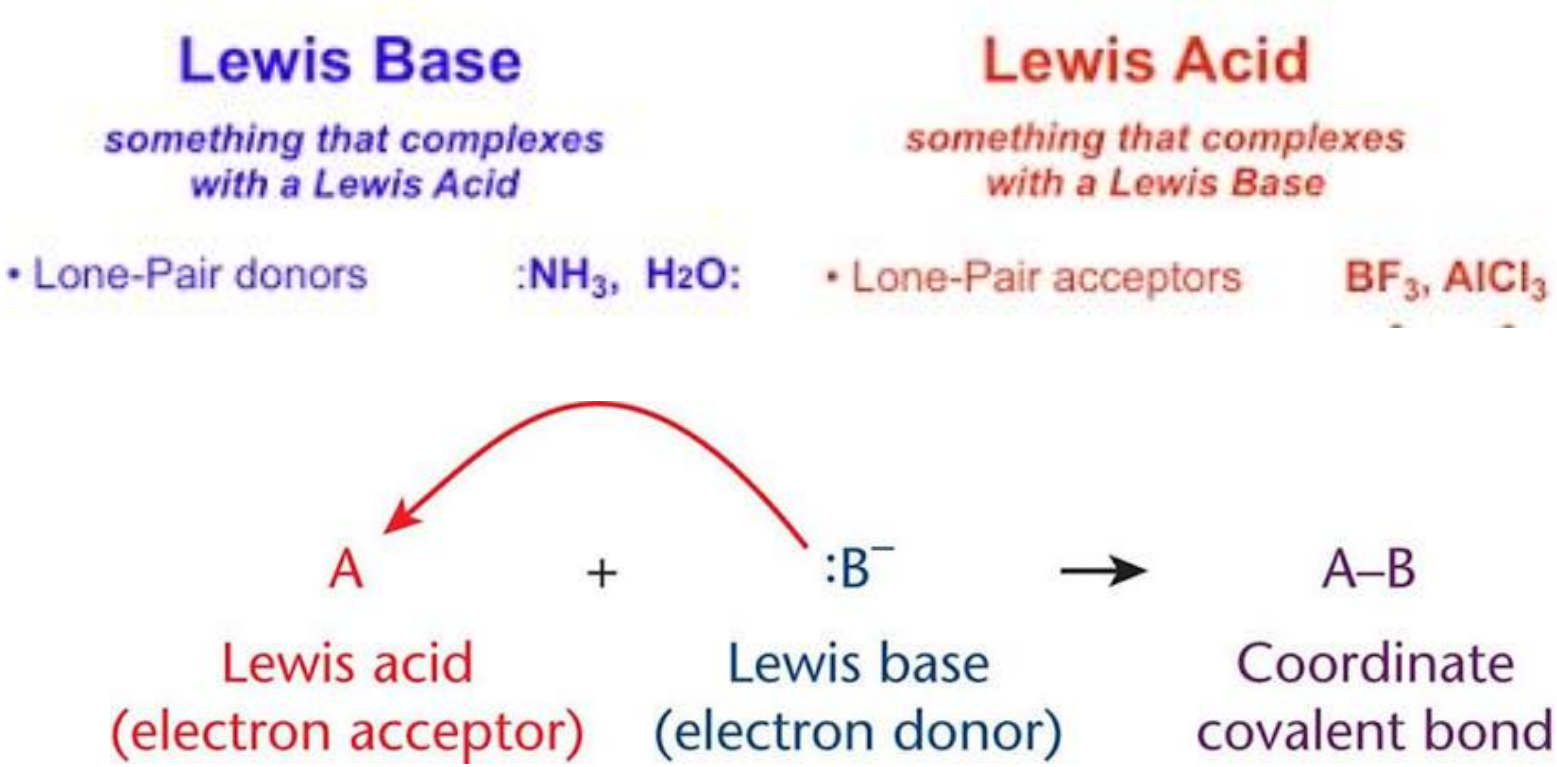
An acid is a proton donor, and a base is a proton acceptor.

Ex- When ammonia dissolve in water the water donates a proton, so it is the acid. The ammonia accepts the proton, so it is the base

($NH_3 + H_2O = NH_4^+ + OH^-$)

Lewis Concept –

A Lewis acid is an electron pair acceptor and a Lewis base is an electron pair donor.



CHEMICAL PROPERTIES OF ACIDS

- Acids react with active metals to give hydrogen gas.

$$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$$

- Acids react with metal carbonate and metal hydrogen carbonate to give carbon dioxide.

$$NaHCO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$$

- Acids reacts with bases to give salt and water. This reaction is called as neutralization reaction.

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

- Acids react with metal oxides to give salt and water.

$$CuO + H_2SO_4 \longrightarrow CuSO_4 + H_2O$$

CHEMICAL PROPERTIES OF BASES

- Reaction with metals – certain reactive metals such as zinc, aluminum react with alkali solution on heating and hydrogen gas is evolved.
- $2NaOH + Zn \longrightarrow Na_2ZnO_2 + H_2$
- Reaction with acids – bases react with acids to form salt and water.
- $KOH + HCl \longrightarrow KCl + H_2O$
- Reaction with non-metallic oxides – these oxides are generally acidic in nature. They react with bases to form salt and water.
- $2NaOH + CO_2 \longrightarrow Na_2CO_3 + H_2O$

❑ Some Important Chemical Compounds:

➢ Common Salt (NaCl)

It is also known as common salt. Its main source is sea water. It is also exists in the form of rocks and is called rock salt.

Common salt is obtained from sea water by the process of evaporation.

Common salt is purified by the process of crystallisation.

Common salt is an important component of our food. It is also used for preparing sodium hydroxide, baking soda, washing soda etc.

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➢ Sodium hydroxide (NaOH)

Prepared by Chloralkali process:

Electricity is passed through an aqueous solution of Sodium chloride (called brine). Sodium chloride decomposes to form sodium hydroxide.

→Chlorine gas is formed at the anode and hydrogen gas at the cathode.

→ Sodium hydroxide solution is formed near the cathode.

$$2NaCl(aq) + 2\ H_2O\ (l) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$$

Bleaching powder:

Chemical name = Calcium oxychloride or calcium hypochlorite.

Chemical formula = $CaOCl_2$.

Bleaching powder is produced by the action of chlorine on dry slaked lime.

$$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O.$$

Baking soda:

Sodium hydrogen carbonate ($NaHCO_3$)

Preparation: $NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$.

Washing soda:

Chemical name = Sodium carbonate decahydrate.

Chemical formula = $N_2CO_3.10H_2O$.

In the first step, sodium carbonate is obtained by heating baking soda.

$2\ NaHCO_3(heat) \rightarrow Na_2CO_3 + H_2O + CO_2$

Then washing sod a is produced by recrystallisation of sodium carbonate $Na_2CO_3 + 10H_2O \rightarrow$

$Na_2CO_3.10H_2O$

Plaster of Paris:

Chemical name = Calcium sulphate hemihydrate.

Chemical formula = $CaSO4.\ ½\ H_2O.$

Prepared by heating Gypsum at 373K.

$$CaSO_4.2H_2O\ (\text{Heat at } 373\ K) \longrightarrow CaSO_4 .\ ½\ H_2O + 1½\ H_2O$$

Indicators

1. Indicators are dyes which change colour when acidic or alkaline solutions are added to them.
2. Some common indicators are *litmus, methyl orange, phenolphthalein and universal indicator.*

Indicators	Colour of indicator	Colour of indicator in	
		Acidic solution	Alkaline solution
Litmus paper	Blue	Red	Blue
	Red	Red	Blue
Methyl orange	Orange	Red	Yellow
Phenolphthalin	Colourless	Colourless	Pink
Universal indicator	Green	Red, orange, yellow	Greenish blue, blue, violet

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Universal Indicator

pH 0 to pH 3: **red**
pH 4 to pH6: **orange/yellow**
pH 7: **green**
pH 8 to pH 10: **dark green/blue**
pH 11 to pH 14: **purple**