Ch-2 (Acid, Bases and Salt)

* NOTES :- The reaction between an acid and a base to give a salt and water is known as a neutralisation reaction. In general, a neutralisation reaction can be written as
Base + Acid → Salt + Water

* Reaction of metallic oxide with acid → Metallic oxide + Acid → Salt + Water
CuO

* Non-metallic oxide with Base.
$CO_2 + Ca(OH)_2 \rightarrow$ Salt + Water

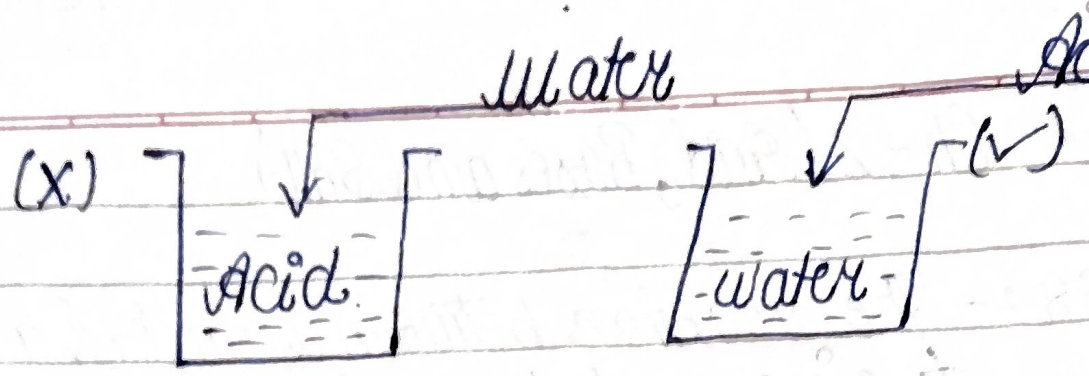
* H → Positive
OH → Negative

* Cation → Positive (HCl)
anion → Negative (H + Cl)

* Acid or Base is water Solution → Acid produce (H^+) ions in the presence of H_2O
$H_2O + H^+ \rightarrow H_3O^+$
- H_3O^+ (Hydronium ions)
- Basis when dissolve in water gives (OH^-) ions-

$$NaOH \xrightarrow[\text{dissolve}]{H_2O} Na^+ (OH^-)$$

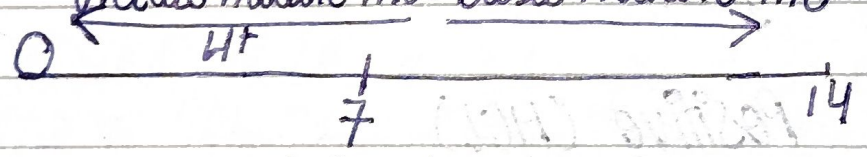
* Why it is recommended that acid Should be added to water and not water to acid ?



* How strong are acid or Base Solutions ?
→ PH Scale to measure H^+ Concentrations.
↓
Potenz ⟶ German
(Power)

→ PH Scale 0 — Basic — 14
9
7
(Acidic)

→ H^+ Strong acidic
OH^+ Strong base



Neutral

→ Gastric Juice – 1·2 (Acidic)
Lemon Juice – 2·2 (Acidic)
Pure water & Blood – 7·4 (Neutral)
Milk of magnisia = 10 (Base)
$Mg(OH_2)$
NaOH – 14 (Base)

* PH in everyday life :-
→ Body PH – 7·C – 7·8
→ Acidic rain → Less than PH 5·6

* PH in our digestive System → To get rid of this pain people use bases called antacids.

→ Tooth decay starts when PH of mouth less than 5.5.

→ Tooth enamel is made of (Calcium hydroxyapatite) Hardest Substance of our body.

→ Table 2.3 Some naturally occuring acids.

Natural Source	Acid	Natural Source	Acid
Vinegar	Acetic acid	Sour milk (Curd)	lactic acid
Orange	Citric acid	lemon	Citric acid
Tamarind	Tartaric acid	Ant Sting	Methanoic a
Tomato	Oxalic acid	Nettle Sting	methanoic a

Some Naturally occuring acids :-
Vinegar — Acetic acids
Orange — Citric acids
Lemon — Citric acids
Tamarind — Tartric acids
Tomato — Oxalic acids
Sour milk — lactic acids
Ant and Nettle Sting — Methonic acids
Acid-Base Indicates — Indicates the presence of an acid or base in a Solution.

Litmus solution - It is a natural Indicator. it is a purple dye extracted from lichens. Others examples are red cabbage and coloured petals of ptunnia and turmeric.

olfactory indicators — Show odour changes in acidic or basic media eg. onion and clove.

Acid - Base indicator

S.No	Name of the Indicator	Colour Change with acid	Colour Change with acid
A.	Blue litmus solution	To red	No Change
B.	Red litmus solution	No change	To blue
C.	Turmeric	No change	To red
D.	Methyl Orange	To red	To yellow
E.	Phenolphthalein (colourless)	No change	To pink

Dilute acid: Contains only a small amounts of acids & a lar amount of water.

Concentrated acid: A concentrated acid contains a large am of acid and a small amout of water.

Chemical properties of acids and Bases.

Acid + Metal → Salt + hydrogen

(Refer activity 2.3 on page no. 19 of NCERT Book)

$2HCl + Zn \rightarrow ZnCl_2 + H_2$

$2HNO_3 + Zn \rightarrow Zn(NO_3)_2 + H_2$

$H_2SO_4 + Zn \rightarrow ZnSO_4 + H_2$

$2CH_3COOH + Zn \rightarrow (CH_3COO)_2Zn + H_2$

Pop test: When a burning candle is brought near a test tube containing hydrogen gas it burns with a 'pop' sound. This test is conducted for examing the presence of hydrogen gas.

Base + Metal → Salt + hydrogen
NaOH + Zn → $Na_2ZnO_2 + H_2$
Sodium Zincate

Note - Such reactions are not possible with all the metals.

Actions of acids with metal Carbonates and metal bicarbonates.
Metal Carbonate + Acid → Salt + Carbondioxide + Water
$Na_2CO_3(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$
Metal bicarbonate + Acid → Salt + Carbondioxide + Water
$NaHCO_3 + HCl \longrightarrow NaCl + CO_2 + H_2O$

Lime water test: On passing the CO_2 gas evolved through lime water.
$Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$
Lime Water — White precipate
On passing excess CO_2 the following reaction takes place.
$CaCO_3(s) + H_2O(l) + CO_2(g) \rightarrow Ca(HCO_3)_2\ aq$
Soluble in water

Neutralisation :- Reactions :-
Base + Acid → Salt + Water
$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$
Neutralisation reactions → Takes place when the effect of a base is multified by an acid and Vice versa to give Salt & Water.

Reactions of metal oxides with acids:-
Metal oxide + Acid → Salt + Water
$CuO + HCl \rightarrow CuCl_2 + H_2O$
Copper Oxide — Hydrochloric acid — Copper chloride + Water

Note: Appearance of blue green colour of the solution because of formation of $CuCl_2$.

Metallic oxides are said to be basic oxides because they give salt and water on reacting with acids.

Reaction of Non metallic oxide with base.
Non metallic oxide + Base → Salt + Water
$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

Note: Non metallic oxides are said to be acidic in nature because on reacting with a base they produce salt and water.

All acidic solution conduct electricity.
Refer activity 2.3 on page 22 of NCRT Book.
- Glowing of bulb indicates that there is a flow of eletric current through the solution.

Acids or bases in a water solution:-
Acids produce H^+ ions in the presence of water.
$HCl + H_2O \rightarrow H_3O^+ + Cl^-$
H_3O^+ - Hydronium ions.
H^+ ions cannot exist home alone. It exists as $H^+(aq)$ or (H_3O^+) hydronium
$H^+ + H_2O \rightarrow H_3O^+$

Bases provide (OH^+) ions in the presence of water.

$NaOH(s) \xrightarrow{H_2O} Na^+(aq) + OH^-(aq)$

$KOH(s) \xrightarrow{H_2O} K^+(aq) + OH^-(aq)$

$Mg(OH)_2(s) \xrightarrow{H_2O} Mg^{2+}(aq) + 2OH^-(aq)$

Alkalis :-

All bases donot dissolve in water. An alkali is a base that dissolves in water.

NaOH Sodium hydroxide
KOH Potassium hydroxide
$Ca(OH)_2$ Calcium hydroxide
NH_4OH Ammonium hydroxide

Note : All alkalis are bases but all bases are not alkalis.

Precaution must be taken while mixing acid or base with water. The acid must always be added to water with constant stirring as it highly exothermic reaction.

When an acid or a base is mixed with water they become dilute. This results in the decrease in the concentration of H_3O^+ or OH^- per unit volume in acids and bases respectively.

Strength of an acids of Base :-

Strength of acids and base depends on the no. of H^+ ions and OH^- ions produced respectively.

With the help of a universal indicator we can find the strength of an acid or base. This indicator is called PH Scale.

PH = Potenz in german means power.

Variation of pH.

S. No.	PH Value	Colour of the PH paper	Nature of Solution	H^+ ion Conc.	OH^- Conc
1.	0	Dark red	Highly acidic	V. high	V. lo
2.	4	Orange or yellow	Acidic	high	low
3.	7:	Green	Neutral	Equal	Equal
4.	10	Bluish green or Blue	Alkaline	low	high
5.	4	Dark blue or violet	highly basic	V. low	V. high

- Strong acids give rise to more H^+ ions.
  eg: HCl H_2SO_4 and HNO_3+
- Weaks acids give rise to less OH^+ ions
  eg: CH_3COOH, H_2CO_3 (Carbonic acid)
- Strong bases - Strong bases give rise to more OH ic
  eg: NaOH, KOH, $Ca(OH)_2$
- Weak Bases: give rise to less OH^- ions
  eg. NH_4OH

More about Salts
Salts and their derivation

Date

S.NO	Name of Salt	Formula	Derived from	" "
1.	Potassium sulphate	K_2SO_4	KOH	H_2SO_4
2.	Sodium sulphate	Na_2SO_4	NaOH	H_2SO_4
3.	Sodium Chloride	NaCl	NaOH	HCl
4.	Ammonium chloride	NH_4Cl	NH_4OH	HCl

Note: NaCl and Na_2SO_4 belong to the family of Sodium Salts as they have the same radicals similarly NaCl and KCl belong to the family of Chloride Salts.

Importance of pH in our daily life:-
Importance of ph in our digestive system - ph level of our body regulates our digestive system. In case of Indigestion our stomach produces acid in a very large quantity because of which we feel pain and irritation in our stomach. To get relief from this pain antacids are used. These antacids neutralise the excess acid and we get relief.

PH of acid Rain: When ph of rain water is less than 5.6 it is called acid rain. When this acidic rain flows into rivers these also get acidic, which causes a theater to the survival of aquatic life.

PH of Soil: plants require a specific range of ph for their healthy growth. if pH of soil of any particular place is less or more than normal than the farmers add suitable fertilizers to it

Spongy.

Use: In house hold, ingrediants of acids.
In making baking power.

On heating baking powder produces
$NaHCO_3 + H^+ \rightarrow CO_2 + H_2O +$ Sodium Salt of acid

Washing Soda
preparation: Recrystallisation of Sodium Carbonate.
$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3\ 10H_2O$

Uses:-
- Used in glass, soap and paper industry.
- Cleaning agent for domestic purpose.
- Remoudl of hardness of water.
- Manufacture of borax.

Water of Crystallisation: fixed no. of water molecules present in one formula unit of a salt

- On heating Copper Sulphate Crystals water droples appear, formula of hydrated Copper Sulphate - $CuSO_4 \cdot 5H_2O$.
- Gypsum also Contains water Crysatalltions.
- Formula of Gypsum - $CaSO_4 \cdot 2H_2O$
- On heating gypsum at 373k it becomes $CaSO_4 \cdot 1/2H_2O$ is plaster of paris.
- Plaster of paris is used as plaster for fractured bones.
- When plasters of paris is mixed with is changes to Gypsum.

$CaSO_4\ 1/2\ H_2O + 1\ 1/2 H_2O \rightarrow CaSO_4\ 2H_2O$

Our body-functions between the range of 7.0 to 7.8 Most organisms can survive only in the narrow range of PH change.

Tooth decay and ph: Bacteria present in the mouth produce acids by degredation of sugar and food particles remaining in the mouth. Using toothpaste which is Generally basic can neutralise the excess acid and prevent tooth decay.

Bee sting or nettle sting contains methanoic acid which causes pain and irritation. When we use a weak base like baking Soda on it we get relief.

Bleaching power

preparation → $Ca(OH)_2$ + Cl_2 → $CaOCl_2$ + H_2O

Calcium hydroxide Chlorine bleaching Water Power

Uses in textile, factorise and laundry, used as disinfectant.

Baking Soda

- Common name → Sodium hydrogen Carbonate

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

Sodium Chloride — Water — Carbon dioxide — Ammonia — Sodium hydrogen Carbonate

On heating $NaHCO_3$ produces:

$NaHCO_3 \xrightarrow{Heat} Na_2CO_3 + H_2O + CO_2$

CO_2 produced causes dough to rise and make cakes, pastries

Uses of plaster of paris: making toys, decorative material and smooth surfaces.

(Excersises)

1/ A Solution turns red litmus blue, its pH is likel
a. 1
b. 4
c. 5
d. 10 ✓

2/ A Solution reacts with crushed egg-shells to giv
that turns lime-water milky. The solutions co
a. NaCl
b. HCl ✓
c. LiCl
d. KCl

3/ 10ml of a solution of NaCl is found to be complet
used by 8ml of a given solution of HCl. if we tak
of NaOH, the amount HCl solution (the same solu
as before) required to neutralise it will be.
a. 4ml
b. 8ml
c. 12ml
d. 16ml ✓

4/ Which one of the following types of medicines is used