

## INORGANIC SALTS

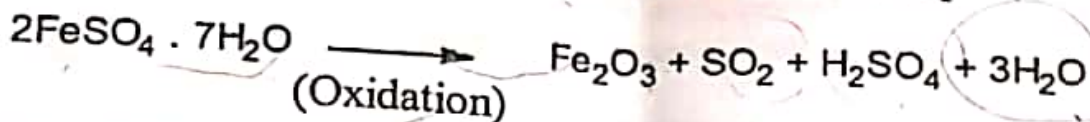
### ✓ FERROUS SULPHATE

Iron (II) sulfate can be found in various states of hydration, and several of these forms exist in nature.

- ❖  $\text{FeSO}_4 \cdot \text{H}_2\text{O}$  (mineral: relatively rare)
- ❖  $\text{FeSO}_4 \cdot 4\text{H}_2\text{O}$  (mineral: white, relatively common, may be dehydration product of melanterite)
- ❖  $\text{FeSO}_4 \cdot 5\text{H}_2\text{O}$  (mineral: relatively rare)
- ❖  $\text{FeSO}_4 \cdot 6\text{H}_2\text{O}$  (mineral: relatively rare)
- ❖  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  (mineral: blue-green, relatively common)

#### PHYSICAL PROPERTIES:-

- ❖ It occurs in the form of greenish crystals or crystalline powder of monoclinic prisms having den 1.89
- ❖ It is odorless.
- ❖ It has astringent taste.
- ❖ In dry air, salt effloresces becomes coated with grayish white powder of anhydrous salt.
- ❖ In moist air, crystals oxidize to a brownish yellow, basic ferrous sulfate salt, which makes it unfit for medicinal preparation.
- ❖ Ferrous sulfate is soluble in water. Salt dissolves in 1-5 times of its wt. of water at 25°C & about less than half of its weight of boiling water to form solution which is acidic to litmus.
- ❖ When heated, ferrous sulfate is decomposed to ferric oxide,  $\text{SO}_2$  &  $\text{H}_2\text{SO}_4$ .



#### CHEMICAL PROPERTIES

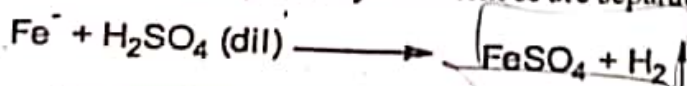
- ❖ In general, it may be said that the reactions of ferrous sulfate are those of the ferrous ion & of sulfate ion.
- ❖ Ferrous sulfate combines with alkali sulfates to form "DOUBLE SALT".  
The most important one of these compounds is ferrous ammonium sulfate.
- ❖ This very stable salt is prepared by dissolving equimolar weights of the two salts in water & crystallizing. It is known as "Mohr's Salt" & is used in analytical chemistry.

#### COMMERCIAL PREPARATION:-

Ferrous sulfate can be manufactured in following ways.

##### 1) FROM IRON & DILUTE SULFURIC ACID:-

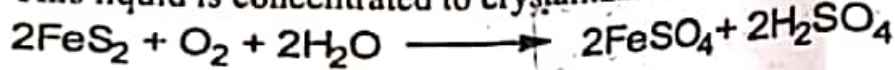
- ❖ The best grade of ferrous sulfate is obtained by dissolving iron in diluted sulfuric acid & concentrating to crystallization.
- ❖ Iron is dissolved in dilute  $\text{H}_2\text{SO}_4$ , after efflorescence diminishing, the liquid is filtered, concentrated & finally cooled.
- ❖ The green crystals form & are separated by filtration at room temperature.



##### 2) FROM IRON PYRITES ( $\text{FeS}_2$ ):-

- ❖ The commercial grades of this salt are made by piling iron pyrites in heaps & exposing to atmospheric oxidation.

- ❖ The mass is reached with water & the dilute solution of ferrous sulfate into large tanks.
- ❖ This liquid is concentrated to crystallization.



### OFFICIAL TESTS FOR IDENTITY OR

### OFFICIAL IDENTIFICATION TESTS FOR FERROUS SULFATE

This salt responds to the tests for

- Ferrous Salt
- Sulfate

#### i) TESTS FOR FERROUS SALT:-

##### TEST 1:-

Take about 10mg of given sample in a test tube, then add 2ml of distilled water and also add 2ml of phenanthroline (Dye) and intense red color is produced.

The colour is discharged by addition of slight excess of 0.1N "GERIC AMMONIUM SULFATE".

##### TEST 2:-

Take 10mg of sample + 2ml of dilute  $\text{H}_2\text{SO}_4$  + 1ml of potassium ferricyanide solution, a white precipitate is formed which is insoluble in dilute HCl & is decomposed by NaOH solution.

##### TEST 3:-

Take 3mg of sample + 2ml of distilled  $\text{H}_2\text{O}$  + 1ml of potassium ferrocyanide solution, a white precipitate is formed, which rapidly becomes blue, & is insoluble in d. HCl.

#### ii) OFFICIAL TEST FOR SULFATE

##### TEST 1:-

Dissolve about 50mg of sample in 5ml of distilled  $\text{H}_2\text{O}$  + add 1ml of Barium Chloride solution, a white precipitate is formed.

##### TEST 2:-

50mg of sample + 5ml of  $\text{H}_2\text{O}$  + 2ml of lead acetate solution. White precipitate is formed, which is soluble in ammonium acetate solution & in NaOH solution.

#### SAY (%age Purity Quantitative Test):-

There are three types of standard solution, used to determine the %age purity;

- N/10  $\text{KMnO}_4$

**Percentage Purity:-**

Finally calculated %age purity of ferrous sulfate using formula;  
 %age purity = Vol. used \* factor \* 100 / Wt. of sample (1g)

$$\text{Factor} = 0.0291\text{g}$$

**USES:-**

- 1) It is used as haematinic to increase the hemoglobin contents.
- 2) It is one of the most commonly used iron preparation, used in anemia's ca- used due to iron deficiency
- 3) It is also used for Dying the fabric.
- 4) It is also used in manufacturing of inks.
- 5) It is also used in photography.

**INTERACTION:-**

Tannins (coffee, tea) interact with iron to decrease the iron level by chelation. So, person taking iron supplement should not take tea or coffee.

**DOSAGE FORMS:-**

- 1) Syrup
- 2) 2) Tablets (Feosal)
- 3) Enteric coated tablets (to eliminate gastric discomfort when FeSO<sub>4</sub> is used).

**FERROUS FUMARATE**

Chemical formula: C<sub>4</sub>H<sub>2</sub>FeO<sub>4</sub>

It is marketed under the trade name of "Toleron".

**PHYSICAL PROPERTIES:-**

The salt has

- 1 - Color: Reddish orange to reddish brown.
- 2 - Odor: odorless
- 3 - Taste: Little ferruginous taste.
- 4 - Solubility:-

- ❖ It is soluble in water to extent of 0.14gm 100 ml of water at 25°C.
- ❖ Acidification of aqueous solutions caused the separation of fumaric acid.
- ❖ 0.45gm of the salt can be dissolved in 100ml of 1N HCl before separation of acid.

**CHEMICAL PROPERTIES:-**

- ❖ It represents a new organic salt of iron that is quite stable to
  - Oxidation
  - Hydration
 Even in a hot, humid atmosphere.
- ❖ Its stability is superior to that of ferrous gluconate & ferrous sulfate.

**USES**

The salt is therapeutically equivalent to ferrous gluconate & ferrous sulfate as a hematinic & that patients exhibit good tolerance to it.

# AMMONIUM CHLORIDE USP

Formula:  $\text{NH}_4\text{Cl}$

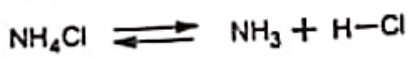
Mol Wt: 53.50

## PHYSICAL PROPERTIES:-

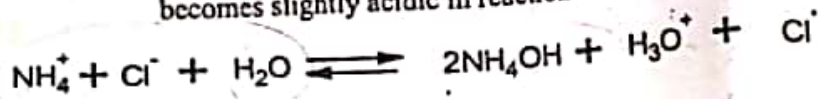
- ❖ It occurs as white, fine or coarse crystalline powder.
- ❖ Odor: Odorless
- ❖ Taste: Cooling, salty taste.
- ❖ Density: Density of about 1.536.
- ❖ Solubility: Very soluble in water.
- ❖ PH: Its aqueous solution is weakly acidic, having PH 4.6.

## CHEMICAL PROPERTIES:-

- ❖  $\text{NH}_4\text{Cl}$  is volatilized when heated, but is not decomposed in the process. Its decomposition is reversible & components reunite again when cooled.



- ❖ Freshly prepared solution of  $\text{NH}_4\text{Cl}$  is neutral in reaction but due to hydrolysis the solution quickly becomes slightly acidic in reaction on standing. A molar solution will develop a ph of 4.6.



## PREPARATION:-

Ammonium chloride is prepared by following methods;

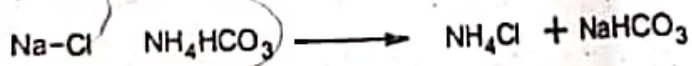
### 1) Destructive Distillation of Coal:-

Ammonical liquid obtained by destructive distillation of coal, is neutralized by  $\text{HCl}$  & the crude product is subsequently purified.

### \*2) Vapours of ammonia from synthetic product are absorbed by $\text{HCl}$ to form $\text{NH}_4\text{Cl}$ .



### \*3) $\text{NH}_4\text{Cl}$ is also produced by reaction of $\text{NaCl}$ with $\text{NH}_4\text{HCO}_3$ (ammonium Bicarbonate).



## USES:-

- 1) It is valuable expectorant, used in cough preparation.
- 2) It shows diuretic action & in large doses produces acidic urine. It is described under heading of "OSMOTIC DIURETIC".
- 3) It is effective in treatment of Alkalosis, for this purpose, it is given by I/V injection.

## CONTRAINDICATED:

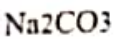
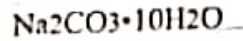
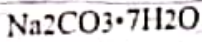
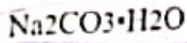
In patients with hepatic & renal impairment because of risk of ammonia toxicity.

## Dosage Form:-

- ❖ Ammonium chloride cough syrup.
- ❖ Ammonium chloride injection.

# ✓ SODIUM CARBONATE

Sodium carbonate exists in following forms;



Monohydrate → effloresced

Heptahydrate

Decahydrate (Washing soda)

Anhydrous (Soda Ash)

Monohydrate sodium carbonate is the official compound

## MONOHYDRATE SOD. CARBONATE USP (XVI)

Formula;  $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$

Mol. Wt; 124.01

### PHYSICAL PROPERTIES:-

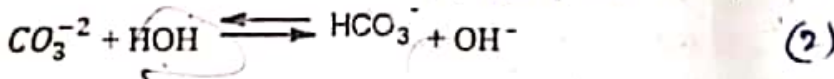
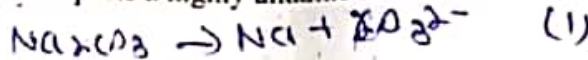
- It is orthorhombic, crystalline or granular powder.
- Color: White
- Odor: Odorless
- Taste: Strong Alkaline Taste.
- Salt absorbs moisture from air but in warm dry air at  $50^\circ\text{C}$  or above, it effloresces.
- Becomes anhydrous at  $100^\circ\text{C}$
- M.P is  $853^\circ\text{C}$ .
- Solubility:-

Soluble in water & insoluble in alcohol

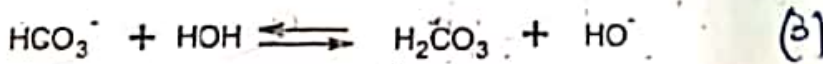
### CHEMICAL PROPERTIES:-

#### 1) HYDROLYSIS:-

$\text{Na}_2\text{CO}_3$  when dissolved in water imparts a highly alkaline reaction to the water as evident by the fact that the pH of a molar solution is 11-6.



Further, hydrolysis takes place to a lesser extent where in another mole of  $\text{OH}^-$  is formed.



#### 3) NEUTRALIZATION REACTION:-

Sodium carbonate in solution or in solid form is capable of neutralizing acids with the formation of a salt,  $\text{CO}_2$  &  $\text{H}_2\text{O}$ .

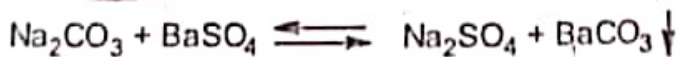


Reaction of  $\text{Na}_2\text{CO}_3$  with acids is the basis of its official assay in which a weighed sample of  $\text{Na}_2\text{CO}_3$  is dissolved in water & filtrated with 1N sulfuric acid. It will be;



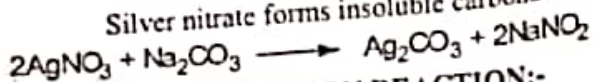
#### 4) DOUBLE DECOMPOSITION:-

Sodium carbonate is used in qualitative analysis b/c of its ability to decompose; difficultly soluble precipitates such as  $\text{BaSO}_4$ ,  $\text{PbSO}_4$ , and  $\text{CaSO}_4$  &  $\text{SrSO}_4$



5) PRECIPITATION REACTION:-

Sodium carbonate is used as reagent to precipitate the insoluble carbonates of other metals e.g ;  
Silver nitrate forms insoluble carbonate with  $\text{Na}_2\text{CO}_3$ .

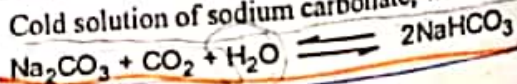


6) SAPONIFICATION REACTION:-

Since aqueous sodium carbonate solution is alkaline, it reacts oils & fats to give soap which is sodium salt of fatty acid.

7) REACTION with  $\text{CO}_2$ :-

Cold solution of sodium carbonate, when treated with  $\text{CO}_2$ , forms bicarbonate

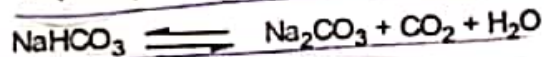
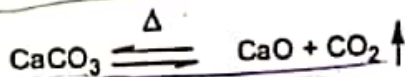


PREPARATION:-

Sodium carbonate  $\text{Na}_2\text{CO}_3$  is obtained by the cryolite soda process: the Solvay process, etc.

SOLVAY PROCESS:-

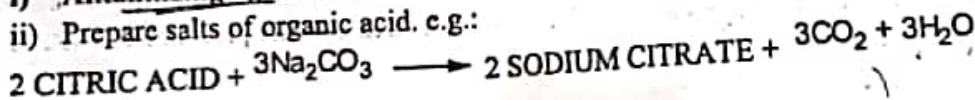
In Solvay process  $\text{Na}_2\text{CO}_3$  is prepared as follows;



USES:-

i) Alkalinizing agent

ii) Prepare salts of organic acid. e.g.:



iii) Solutions of  $\text{Na}_2\text{CO}_3$  are employed as lotions in skin diseases such as; Scaly eruptions, psoriasis etc.

iv) They tend to dissolve skin oils & Horney matter on skin surface, thus "softening the skin".

## SODIUM BICARBONATE USP

(BAKING SODA)

Formula:  $\text{NaHCO}_3$

Mol.Wt: 84.01

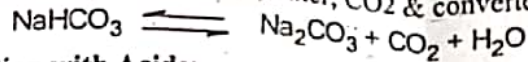
PHYSICAL PROPERTIES:-

- ❖ White, odorless, crystalline powder.
- ❖ Stable in dry air & but in moist air is slowly decomposes into  $\text{Na}_2\text{CO}_3$ ,  $\text{CO}_2$  &  $\text{H}_2\text{O}$ .
- ❖ Specific gravity is 2.206.
- ❖ Soluble in water at  $25^\circ\text{C}$  & insoluble in alcohol.

CHEMICAL PROPERTIES:-

## Concise & Conceptual Medicinal Chemistry

- 1) When heated, the salt loses water, CO<sub>2</sub> & converted to normal carbonate.



- 2) Reaction with Acids:-

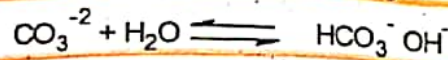
When heated with acids, liberates CO<sub>2</sub> the liberated CO<sub>2</sub> bubbling through liquid is called effervescent.



- 3) Aqueous solutions of sodium bicarbonate are slightly of the Bicarbonate ion.

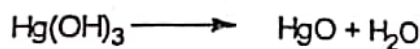


- ❖ The bicarbonate ion ionizes, also to slightly extent, but the amount of ionization is so small as to be negligible.



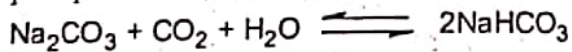
- 4) REACTION WITH MERCURY SALTS:-

The sodium bicarbonate reacts with mercuric chloride (HgCl<sub>2</sub>) as;



### PREPARATION:-

To achieve a higher grade of purity, the more or less crude product from the "Solvay Process" is heated to convert it to soda ash (anhydrous Na<sub>2</sub>CO<sub>3</sub>) the soda ash is then dissolved in water & is treated in the presence of CO<sub>2</sub> to precipitate NaHCO<sub>3</sub>, which is washed & dried, is of high grade of purity.



### USES:-

- ❖ Used as antacid to fight gastric hyperacidity.
- ❖ Used as urine alkalinizer.

### NOTE

Excessive use may produce rebound acidity leading to "Peptic ulcer".

### ASSAY / DETERMINATION:-

Filtrate NaHCO<sub>3</sub> against H<sub>2</sub>SO<sub>4</sub> & use methyl red as an indicator.

### DOSAGE FORM:-

- ❖ Tablets (Soda mint tablets).
- ❖ Present in effervescent preparations (Eno Salt).

# SODIUM NITRATE

Formula;  $\text{NaNO}_2$

Molecular Weight; 69.00

## PHYSICAL PROPERTIES:-

- 1) Sodium nitrate occurs in the form of:
  - ❖ White or nearly white, opaque, fused masses or sticks;
  - ❖ Colorless or transparent, hexagonal crystals, of
  - ❖ White or slightly yellow granular powder.
- 2) It is odorless & has mild saline taste.
- 3) Its specific gravity is 2.168 at  $20^\circ\text{C}$ .
- 4) When exposed to the atmosphere, it deliquesces and is slowly oxidized. It dissolves in 1.5ml of water at  $25^\circ\text{C}$ . It is very soluble in boiling water but only sparingly soluble in alcohol.

## CHEMICAL PROPERTIES:-

### 1) HYDROLYSIS:-

Aqueous solutions of sodium nitrite are alkaline because nitrous acid is a weak acid & its salts are appreciably hydrolyzed:



### 2) REACTION AS REDUCING AGENT:-

- ❖  $\text{NaNO}_2$  acts as both reducing and oxidizing agent, it is itself oxidized to the nitrate. Potassium permanganate, is reduced when treated with sodium nitrite in acid solution.

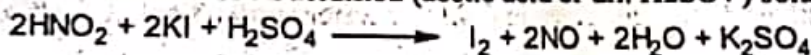


- ❖ The chlorates of the alkali metals are likewise reduced by acidified solutions of the nitrite.



### 3) REACTION AS OXIDIZING AGENT:-

- ❖ The oxidizing action of the nitrites is accompanied by formation of nitric oxide (NO) of Nitrogen.
- ❖ The oxidation of an acidified (acetic acid or dil.  $\text{H}_2\text{SO}_4$ ) solution of potassium iodide to iodine.



- ❖ Oxidation of ammonium chloride is as follows:



## COMMERCIAL MANUFACTURE:-

$\text{NaNO}_2$  is prepared by following methods:

- 1) The reaction of  $\text{NaNO}_3$  (sodium nitrate) with lead yields lead oxide and sodium nitrite.

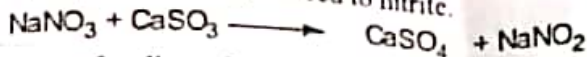


- 2) Sodium nitrite is also made by mixing a concentrated solution of sodium nitrate with quicklime ( $\text{CaO}$ ). The mixture is heated & then air free sulfur dioxide is passed through it. The precipitate is allowed to settle & the supernatant liquors filtered & concentrated to crystallization.





- 3) When a mixture of sodium nitrate & sodium hydroxide is fused at 300°C and anhydrous calcium sulfide added, the nitrate is reduced to nitrite.

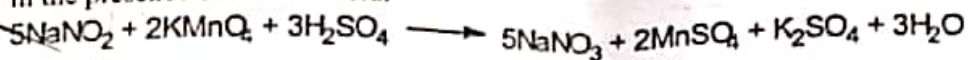


- 4) Most of sodium nitrite is now obtained by absorbing the NO gases, resulting from the catalytic oxidation of ammonia in NaCO<sub>3</sub>.



### ASSAY

Sodium nitrite (NaNO<sub>2</sub>) is assayed by titrating it against a standard solution of potassium permanganate, in the presence of sulfuric acid.



### USES:-

- 1) Nitrite ion relaxes smooth muscles (especially that in the smaller blood vessels); this action lowers blood pressure. So, organic derivatives containing nitrite of nitro group e.g.; Nitrogenous ring or Amyl nitrate used as coronary vasodilators in "treatment of Angina Pectoris".
- 2) It is also used in the "treatment of cyanide poisoning as it acts as antidote".
  - ❖ It is administered intravenously for this purpose in a dose of 10ml of 3% solution.
  - ❖ Mechanism: - Nitrates have the ability to form net hemoglobin when injected into animal body. Met hemoglobin reacts with cyanide ion to form cyanmethemoglobin in which form the cyanide ion is incapable of exerting its toxic effects.
- 3) With sodium carbonate, it is also as a reducing agent.

## SILVER NITRATE

### PHYSICAL PROPERTIES

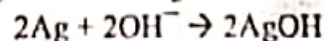
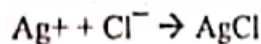
- ❖ Silver nitrate occurs as colorless or white, rhombic crystals; which are odorless, having a bitter, caustic metallic taste.
- ❖ When pure, the salt is not affected by light.
- ❖ However, in the presence of organic matter (skin, cloth, etc) & light is soon becomes gray or black due to liberated silver, hence it is used in marking inks.
- ❖ It is water soluble; one Gm of silver nitrate dissolves in 0.4ml of water and in 30ml of alcohol at 25°C. It is slightly soluble in ether.

### CHEMICAL PROPERTIES

Silver nitrate embodies the chemical reactions of silver ion & nitrate ion.

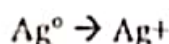
#### 1) HYDROLYSIS:-

Aqueous solution of silver nitrate gives silver ion. So it will give test for silver ion. i.e;



#### 2) REACTION WITH ALKALI HYDROXIDE:-

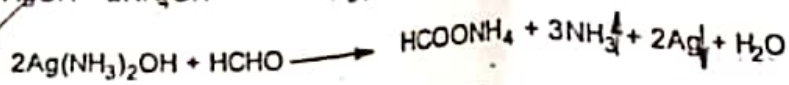
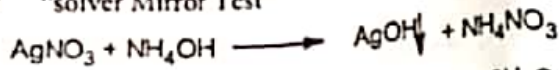
The reaction with alkali hydroxide is given as;



Ag is oxidized to Ag<sup>+</sup>

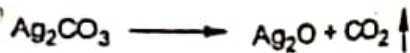
### 3) SILVER MIRROR TEST:-

Ammonical solution of silver nitrate on reaction with reducing agents e.g; Formaldehyde gives "silver Mirror Test"



### 4) REACTION WITH SODIUM CARBONATE:-

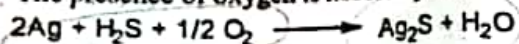
Addition of sodium carbonate to the solution of silver salts, causes the precipitation of white silver carbonate, which can be decomposed by boiling to give silver oxide.



### 5) REACTION WITH hydrogen sulphide:-

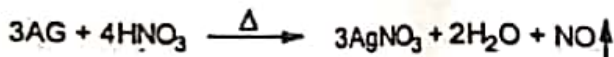
When silver salts, treated with substances containing sulfur e.g.: coal, gas, eggs, rubber, perspiration, hydrogen sulfide, sulfur dioxide, Black silver sulfide is formed on reaction of silver with sulfur.

The presence of oxygen is necessary for the reaction with H<sub>2</sub>S.



### 6) REACTION WITH ACIDS:-

Silver present in silver salts, on reaction with oxidizing acids i.e. Nitric acid and hot sulfuric acid gives



### COMMERCIAL MANUFACTURE:-

About 3 parts of metallic silver are mixed with 10 parts of 25% Nitric acid.

The mixture is gently warmed, as the silver is dissolved, the solution is filtered & evaporated to dryness.



### USES

- 1) Silver ion is a protein precipitant this gives a germicidal activity, the action of it may be antiseptic, astringent. Depending on the concentration of its solution, silver nitrate is used for the effects that vary from a caustic effect to that of an antiseptic.
- 2) The corrosive effect of silver nitrate is used to destroy tissues & needs high concentration of silver ions e.g.: Silver nitrate pencil (toughened silver nitrate); is used for removing warts & other skin excrescences
- 3) In the form of a 1% solution, it is routinely used as an instillation in the eyes of newborn babies to treat gonorrhoeal infections (of eye).

For this purpose, is available as "1% eye drops"

- 4) Silver nitrate is also used in making "inks"

**NOTE**

- ❖ The removal of silver nitrate stains from the skin & clothing is a problem for pharmacist.
- ❖ Fresh stains may be removed from skin by painting places with tincture of iodine & then removing this with sodium Thiosulfate solution.
- ❖ Stains from clothing may sometimes be removed by judicious use of potassium cyanide (keeping in mind its poisonous characteristics).

**ALUMINIUM HYDROXIDE**

Aluminum Hydroxide Gel.  
Dried Aluminum Hydroxide Gel  
Formula, Al (OH)<sub>3</sub>  
Molecular Weight, 77.99

**PHYSICAL PROPERTIES**

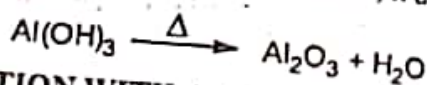
- ❖ THE Gel is which, viscous suspension, translucent in thin layers.: from which small amounts of water may be separated on standing.
  - ❖ The dried Gel is a white, odorless, tasteless, amorphous powder.
- Aluminum Hydroxide is insoluble in water but readily soluble in acids & fixed alkali.

**CHEMICAL PROPERTIES:-**

- ❖ Aluminum Hydroxide gel is amphoteric in nature as it slightly affects both red & blue litmus paper.

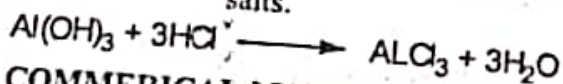
**1) DECOMPOSITION REACTION**

When it is heated to redness, it decomposes into water & aluminum oxide.



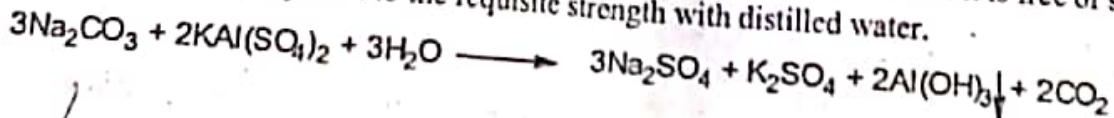
**2) REACTION WITH ACIDS**

The hydroxide reacts with acids readily i.e. hydrochloric acid forming the water & the aluminum salts.



**COMMERICAL MANUFACTURE**

- ❖ Hot solution of potash alum is added slowly to a hot solution of sodium carbonate. The aluminum hydroxide is precipitated & is then washed thoroughly with hot water until it is free of sulfate ions.
- ❖ Finally the gel is adjusted to the requisite strength with distilled water.



**NOTE:-**

Hot water not the boiling water should be used to wash the precipitates because the latter tends to decompose the Al (OH)<sub>3</sub>

**ASSAY**

Assay of Al(OH)<sub>3</sub> is performed titrating Al(OH)<sub>3</sub> gel against a standard solution of hydrochloric acid (HCl).

**USES:-**

**A) COLLOIDAL ALUMINIUM HYDROXIDE GEL**

- ❖ It is used as an antacid.

- ❖ Used as protective in treating peptic ulcer.
  - ❖ It acts as astringent & antiseptic, b/c of aluminum ions formed by its solution in the hydrochloric acid of the stomach, is a distinct advantage over soluble alkalis.
  - ❖ Because of its astringent action, the tendency to constipation may be overcome by administering "Magnesium Trisilicate" simultaneously.
  - ❖ Intestinal bacteria are also absorbed by the aluminum hydroxide, not dissolved in the stomach.
  - ❖ It is used in cases of marked hyperacidity.
- B) DRIED ALUMINUM HYDROXIDE GEL**
- ❖ Dried aluminum hydroxide gel, may be suspended in distilled water to make the official aluminum hydroxide gel.
  - ❖ It is used externally as a mild astringent & desiccant.
  - ❖ It is used internally as an antacid & protective.
  - ❖ It is infrequently used in the treatment of diarrhea and cholera, externally as a dusting powder for desiccating foul wounds etc.
  - ❖ It is constituent of some foot powders.

## AMMONIUM CHLORIDE

Formula:  $\text{NH}_4\text{Cl}$

Molecular Weight: 53.50

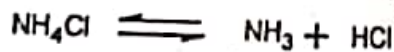
### PHYSICAL PROPERTIES:-

- ❖ Ammonium chloride occurs in the form of a white fine of coarse crystalline powder
- ❖ Odorless: Salt is odorless.
- ❖ Taste: A cooling, Salty taste
- ❖ Density: 1.536
- ❖ It is slightly hygroscopic.
- ❖ It is very soluble in water, 1 gm dissolving in 2.6ml of water at 25C and in 1.4ml of boiling water.

### CHEMICAL PROPERTIES

#### DECOMPOSITION REACTION

- ❖ Ammonium chloride is volatilized when heated, but is not decomposed in the process
- ❖ It is said that, the salt is decomposed reversibly when heated, but the components reunite when cooled again.
- ❖ It is impossible to obtain ammonia from ammonium chloride by ordinary heating.



#### 1. HYDROLYSIS:-

Ammonium chloride is hydrolyzed as follows:



Freshly prepared solutions of  $\text{NH}_4\text{Cl}$  are neutral in reaction, but due to hydrolysis, the solutions quickly become slightly acidic on standing. A molar solution will develop a pH of about 4.6.

#### 2. REACTION WITH SODIUM HYDROXIDE:-

The reaction of ammonium salt with strong bases ( $\text{NaOH}$ ) liberates small amount of  $\text{NH}_3$



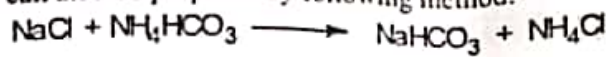
3. REACTION WITH TARTARIC ACID:-

NH<sub>4</sub>Cl forms a white crystalline precipitates of ammonium bitartrate with tartaric acid



PREPARATION:-

- ❖ The ammonial liquid obtained from destructive distillation of coal is utilized with HCl & the crude product is subsequently purified.
- ❖ Ammonium chloride has also been made by the direct union of equal volumes of ammonia and hydrogen chloride in the presence of a small amount of moisture.
- ❖ Ammonia cal gas liquors are treated with lime (CaCO<sub>3</sub>) & the liberated ammonia passed into hydrochloride. The salt is purified by crystallization and sublimation.
- ❖ NH<sub>4</sub>Cl can also be prepared by following method:



USES

- ❖ Because of the characteristic action of ammonium ion in the thinning the secretions, particularly the saliva & mucus; this salt is a valuable expectorant; so, is used in cough preparation.
  - ❖ It also exhibits a Diuretic Action.
  - ❖ In large doses produces acid urine.
  - ❖ It intensify action of mercurial diuretics
- Ammonium chloride is effective in treating alkalosis, when introduced intravenously in a 2% solution of saline with dextrose. Dosage forms; Tablets 300mg & 500mg.

*Handwritten notes:*  
 Al(OH)<sub>3</sub>  
 NH<sub>4</sub>Cl  
 CaCO<sub>3</sub>  
 Ca<sup>2+</sup>  
 carbonate

**LITHIUM CARBONATE**

Formula: Li<sub>2</sub>CO<sub>3</sub>

PHYSICAL PROPERTIES

- ❖ It is white powder.
- ❖ It is water soluble.

CHEMICAL PROPERTIES

- 1) Its reaction due to Lithium are;

IGNITION

Lithium ignites in air at 200°C; & burns quietly with a very intense, white light.

- 2) REACTION WITH OXYGEN

The metal unites vigorously with oxygen.



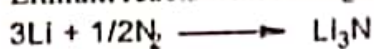
- 3) REACTION WITH HYDROGEN

Lithium unites with hydrogen to form Lithium Hydride.



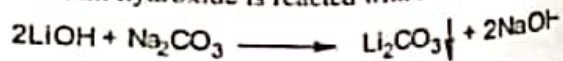
- 4) REACTION WITH NITROGEN:-

Lithium reacts with Nitrogen to form Lithium Nitrate.

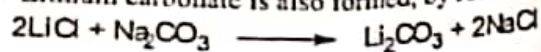


## PREPARATION

1- Lithium hydroxide is reacted with sodium carbonate to form sodium carbonate.



2- Lithium carbonate is also formed, by reaction of Lithium chloride with sodium carbonate.



## USES

$\text{LiCO}_3$  is used in depressive disorders, characterized by extreme emotions and behavior.

## TOXIC EFFECTS

GIT: Vomiting, Diarrhea.

In such case dose should be reduced.

CNS: Blurred vision confusion etc.

They require immediate withdrawal of the drug & administration of NaCl who facilitates the excretion of Lithium.

Others: Hypotension, Diabetes etc.

## PHARM KINETICS

❖ Completely absorbed after oral administration

❖ Its plasma half life is approximately "24hours"

## PRECAUTION:-

❖ It should not be used in patients with renal and cardiovascular effects.

## DOSAGE:-

❖ Tablets, Capsules & syrup.

# MAGNESIUM CARBONATE

## FORMULA

Light magnesium carbonate:  $3\text{MgCO}_3 \cdot \text{Mg}(\text{OH})_2 \cdot 3\text{H}_2\text{O}$

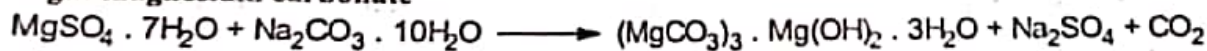
Heavy Magnesium carbonate:  $3\text{MgCO}_3 \cdot \text{Mg}(\text{OH})_2 \cdot 4\text{H}_2\text{O}$

## PROPERTIES

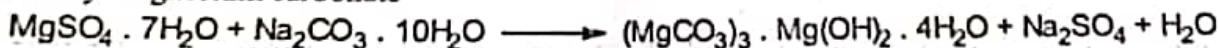
- ❖ White Granular Powder
- ❖ Insoluble in water.
- ❖ Soluble in acid with effervescence.
- ❖ Antacid properties are due to carbonate & hydroxyl ion.

## PREPARATION:-

Light magnesium carbonate



Heavy magnesium carbonate



- ❖ Magnesium sulphate (125 parts) and crystalline sodium carbonate (150 parts) are dissolved. Separately, in each 250ml (parts) of boiling water. The solutions are mixed & evaporated to dryness; the precipitates are washed until free from sulphate & dried in oven.

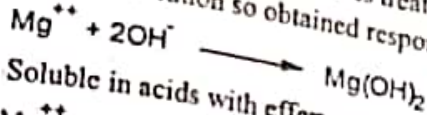
- ❖ To prepare heavy magnesium carbonate the precipitates obtained after mixing two solutions are digested in boiling water (500 parts) for half an hour, then insoluble carbonate after filtration, washed until free from sulphate & dried in an oven.

**USES:-**

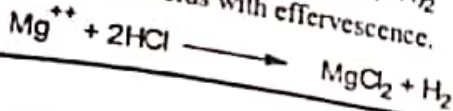
- ❖ Antacid.
- ❖ Laxative (in large doses)

**OFFICIAL TESTS FOR IDENTITY:-**

- When magnesium carbonate is treated with dil. HCl, it dissolves with liberation of CO<sub>2</sub>
- Aqueous solution so obtained responds to test for magnesium ion e.g;



- Soluble in acids with effervescence.



**CALCIUM GLUCONATE**

Molecular Weight: 130.39.

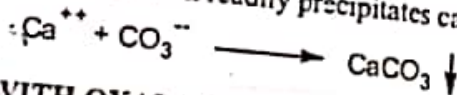
**PHYSICAL PROPERTIES:-**

- Calcium gluconate occurs as white, crystalline or granular powder without odor or taste.
- It is stable in air.
- It is sparingly soluble in water but is freely soluble in boiling water.

**CHEMICAL PROPERTIES:-**

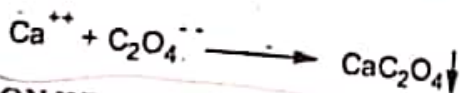
- ❖ Reactions are due to Ca<sup>+</sup> ions. The chief chemical reaction involving calcium ion, are those compound of carbonate, hydroxide, sulfate, oxalate & Phosphate.
- ❖ Reaction with carbonates:-

Carbonate ion readily precipitates calcium as the insoluble carbonate.



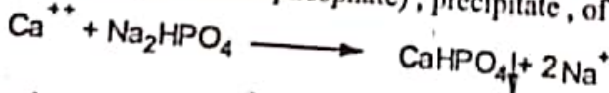
**REACTION WITH OXALATE SALT:-**

Soluble oxalate salts also precipitate calcium as insoluble calcium oxalate.



**REACTION WITH SODIUM PHOSPHATE:-**

- ❖ When neutral solution of calcium salts are treated with soluble phosphates (sodium phosphate), precipitate, of insoluble secondary calcium phosphate forms.

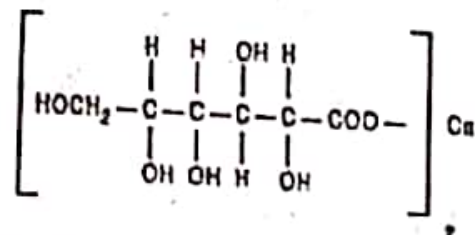


However the solution is made alkaline ammonical the precipitate which forms is tertiary calcium phosphate. i.e.



**REACTION WITH SULFATE ION:-**

- ❖ Calcium ion is also precipitated by sulfate ions as more or less insoluble calcium sulfate.

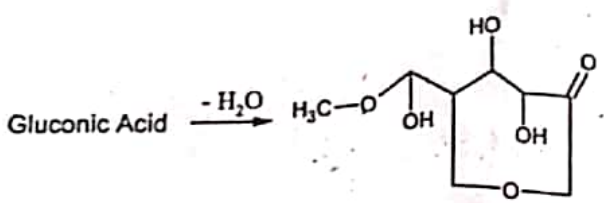
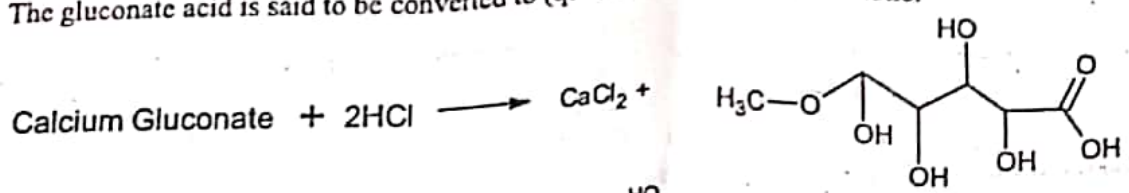




### REACTION WITH ACIDS

Additions of hydrochloric acid or other acids to solutions of calcium gluconate cause the formation of gluconic acid in solution.

The gluconate acid is said to be converted to (quite easily) d-gluconolactone.



### MANUFACTURE:-

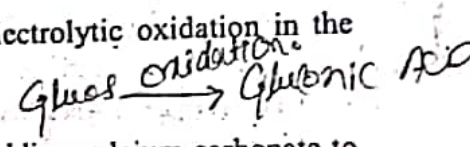
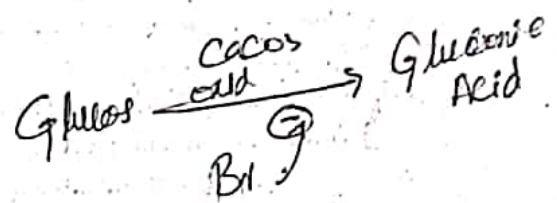
Calcium gluconate can be prepared by following two methods;

#### 1) 1<sup>st</sup> method

- ❖ Oxidation of glucose to gluconic acid in the presence of calcium carbonate.
- ❖ In this method, oxidation of glucose is affected either by bromide or by electrolytic oxidation in the presence of sodium bromide.

#### 2) 2<sup>nd</sup> method

- ❖ Calcium gluconate may be prepared by first preparing gluconic acid & then adding calcium carbonate to form the salt.
- ❖ In this procedure, gluconic acid is usually obtained by the action of various moulds, or bacteria of the Acetobacter group upon glucose:



Glucose  $\rightarrow$  gluconic acid  $\rightarrow$  calcium gluconate

### USES

- ❖ It is used as source of calcium ion both for oral, intravenous and intramuscular use, and in that, it has a better taste & is much less irritating.
- ❖ A electrolyte (calcium) replenisher.
- ❖ Calcium gluconate tablets are used extensively in supplementing the diet of convalescent and expectant mothers.

Mothers

### SIDE EFFECTS

- ❖ In case of over dosage, vomiting, weakness death can occur.
- ❖ Too rapid injection produces burning sensation.

### OSAGE FORMS

- ❖ Tablets
- ❖ Injection.