

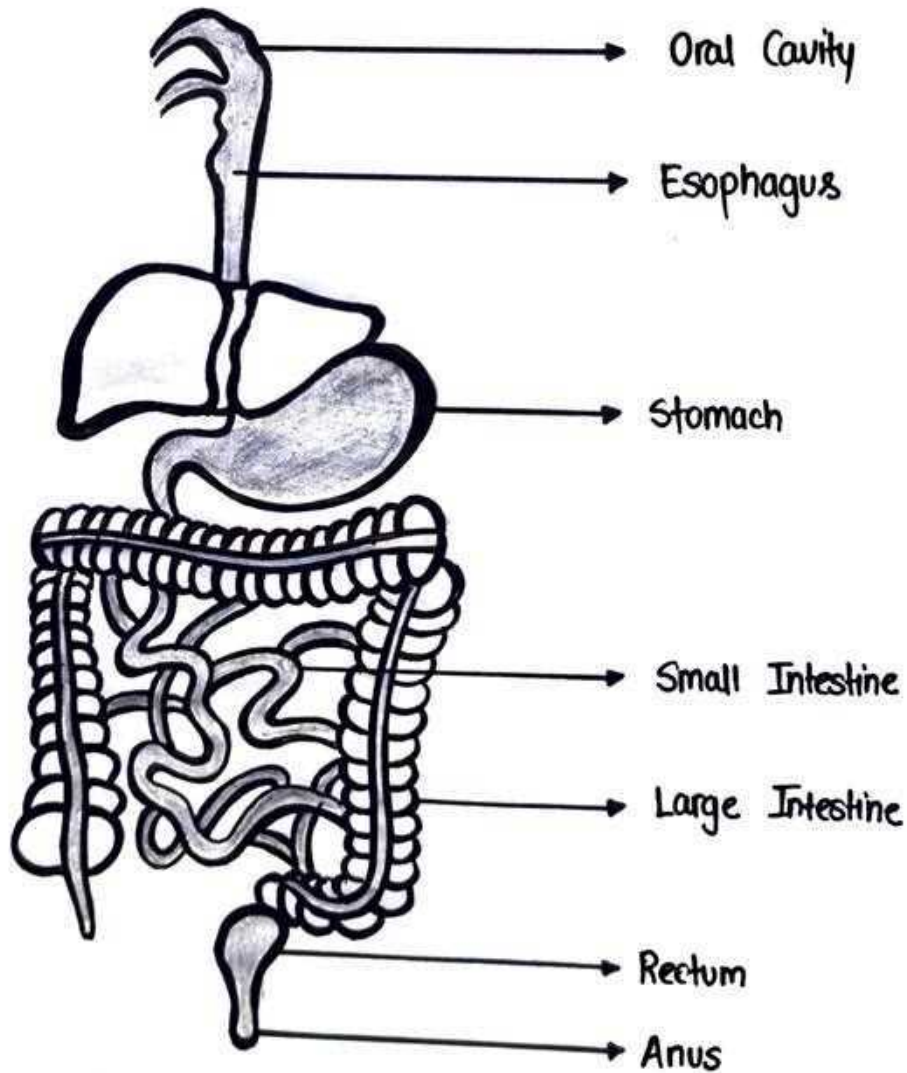
PHARMACEUTICAL INORGANIC CHEMISTRY

UNIT 3 NOTES

- **GASTROINTESTINAL AGENTS**

GASTROINTESTINAL TRACT

- The gastrointestinal tract is the pathway of digestive system which helps in the digestion of food and its excretion.
- It starts from the mouth and end to the anus.
- The main portion of GIT includes the stomach, small intestine, large intestine, rectum and anus.
- Now, whenever the function of GIT goes wrong, disease occurs.



Diseases OF GIT

- Insufficient secretion of acid in the stomach can cause Achlorhydria or Hypochlorhydria.
- Too much secretion of acid in the stomach can cause Hyperacidity.
- The insufficient bowel movement in the intestine can leads to Constipation
- Also the growth of microbes/ bacteria can affect the Gastrointestinal Tract.

GASTROINTESTINAL AGENTS

- Agents that are used to treat gastrointestinal disturbance / diseases are known as Gastrointestinal Agents.
- Agents that are used to GIT disorders includes :
 - ① Acidifiers (Hypochlorhydria)
 - ② Antacids (Hyperacidity)
 - ③ Cathartics (Constipation)
 - ④ Antimicrobials (Microbial Growth)

ACIDIFIERS

- These are the inorganic substances that are used to increase the level of gastric acid in the stomach.
- They are also known as Acidifying Agents.
- They either produce acid or increase the level of acid.
- They work by decreasing the pH of stomach.
- They are used in the treatment of Achlorhydria or Hypochlorhydria.

Why Acid is Important in the Stomach ?

- It breakdown the food and help in digestion.
- Kill microbes present in the food.
- Provide acidic environment needed for effective digestion.

Types Of Acidifiers

There are mainly 3 types of Acidifiers

- ① Gastric Acidifiers
- ② Urinary Acidifiers
- ③ Systemic Acidifiers

Gastric Acidifiers

- They are mainly used to control the pH of stomach.
- These are the drugs which are used to increase the acidity of stomach.
- These agents are mainly used in patients suffering from Achlorhydria or Hypochlorhydria.

Urinary Acidifiers

- They are mainly used in controlling the pH of urine.
- These are the drugs which are used to remove acidic urine from the body.
- These acidifiers are widely used to cure some type of Urinary Tract Infection.

Systemic Acidifiers

- They are used to control the pH of all parts of body.
- These are the drugs which are able to neutralized the alkaline body fluid.
- It is used to treat patient suffering from Alkalosis.

AMMONIUM CHLORIDE

Molecular Formula : NH_4Cl

Molecular Weight : 53.49 g/mol

Synonym : Sal Ammoniac

Method of Preparation

It is prepared by the reaction of HCl with NH_3 (ammonia)



Physical Properties

- It is a white crystalline powder
- It is odourless.
- It has cool saline taste
- It is hygroscopic in nature

Chemical Properties

On decomposition ammonium chloride produces ammonia gas and hydrogen chloride.



Uses of Ammonium Chloride

- It is used as Acidifiers.
- It is used as Fertilizers.
- It is used in Glue.
- It is also used in Buffer Solutions.

DILUTE HCL

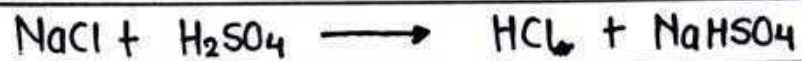
Molecular Formula : HCl

Molecular weight : 36.46

Synonym : Spirit of Salt

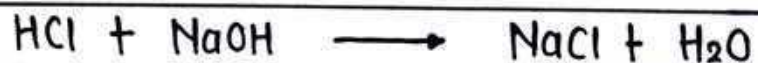
Preparation

It can be prepared by action of concentrated H_2SO_4 with NaCl



Properties

- It is a colourless liquid
- It is strongly acidic
- It is soluble in water and alcohol
- It has pungent odour
- On reacting with NaOH, it gives salt and water.



Uses

- It is used as acidifiers
- It is mainly used as an pharmaceutical acid
- Used in many solvents.

ANTACIDS

- Antacids are the drugs that are used to decrease the level of gastric acid in the stomach.
- They are used in the case of Hyperacidity.
- They also prevent from Heart Burn and Ulcer.
- Antacids are generally weak bases that reacts with the excessive acid in the stomach and convert them into salt.
- They work by increasing gastric pH.
- example : CaCO_3 , NaHCO_3

Classification of Antacids

Antacids are commonly classified into two groups :

- ① Systemic Antacids
- ② Non- systemic Antacids

Systemic Antacids

- Antacids which absorbs in the systemic circulation (blood circulation) are called as Systemic Antacids.
- They are not very suitable antacids as they can cause Metabolic Alkalosis (Disturbance in acid- base balance)

Non- Systemic Antacids

- Antacids which are not absorbed into systemic circulation and do not affect acid- base balance of the body are called as Non- Systemic Antacids

Ideal Properties of Antacids

- It should be insoluble in water and has fine particle form.
- It should not cause metabolic alkalosis.
- It must have its effect over a long period of time.
- It should not cause constipation.
- It should not cause any side effect.
- It should be stable and readily available.
- It should not be too expensive.

Combination of Antacids

- Systemic antacids are not used regularly as they can cause metabolic alkalosis and congestive heart failure.
- Non-systemic antacids are more effective compared to systemic alkalosis, but they also have some other side effects.
- To avoid these side effect and to increase the effect and time of duration of action. antacids are generally given in combination.
- Generally in the combination of antacids, one having a rapid action and other having longer duration of action.
- Example : Combination of Magnesium and Aluminium as Antacid
 - (i) Magnesium → Fast acting
 - (ii) Aluminium → Longer duration of action

SODIUM BI CARBONATE

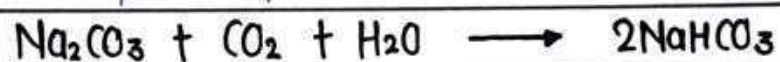
Chemical Formula : NaHCO_3

Molecular weight : 84.01 g/mol

Synonym : Baking Soda

Preparation

It is prepared by solvay ammonia process.



Properties

- It is a white crystalline powder.
- It is insoluble in ethanol but soluble in methanol
- It having saline taste
- It is alkaline in nature
- It is also soluble in water

Uses

- It is mainly used as antacids.
- It is used as electrolyte replenisher.
- It is also used as disinfectant.

ALUMINIUM HYDROXIDE GEL

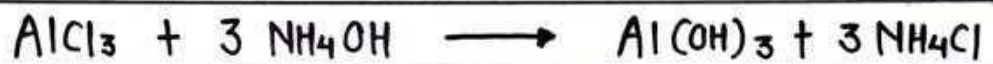
Chemical Formula : Al(OH)_3

Molecular Weight : 78.00 g/mol

Synonym : Aluminium Hydrated Powder

Preparation

It is prepared when Aluminium Chloride is treated with Ammonium Hydroxide



Properties

- It is a white viscous suspension
- It is tasteless.
- It is odourless.
- It is soluble in mineral acid solution, but insoluble in water & alcohol.

Uses

- It is used as antacid.
- It is used to treat heartburn

CATHARTICS

- Cathartics are the drugs that are used to get relief from constipation.
- These are the drugs that accelerates defecation.
- Cathartics act by increasing the fluid content of Faeces, making them softer and easier to pass.
- Cathartics increases the mobility of intestine

Types of Cathartics

Cathartics are mainly classified into two categories :

- ① Laxative
- ② Purgative

Laxative

- Laxatives are mild acting cathartics
- They work by either :
 - Increasing intestinal movement
 - Increasing stool bulk
 - Make stool softer
- Prolong use of laxative may cause habit or dependency.

Purgative

- They are strong cathartics
- They are given in very serious conditions.
- They are generally given to completely remove solid materials from intestine before surgery.

Classification (On the basis of mechanism)

- ① Stimulant Cathartics
- ② Lubricants
- ③ Bulk Forming
- ④ Saline Cathartics

Stimulant Cathartics : They act by producing local irritation on intestinal tract.

Lubricants : Provide lubricant effect so that stool easily passes through rectum, also known as stool softeners.

Bulk Forming : These agents increases the amount of stool production.

Saline Cathartics : They increases the osmotic load of GIT, consumed with large amount of water.

Uses of Cathartics

- For easy defecation & other rectal diseases.
- To relief from acute constipation.
- To remove solid material from intestinal tract before surgery.
- To avoid rise in blood pressure due to constipation.

Magnesium Sulphate

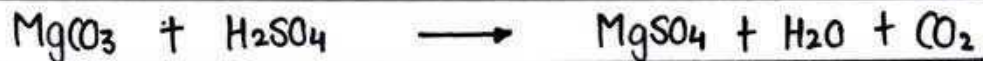
Chemical Formula : $MgSO_4 \cdot 7H_2O$

Molecular Weight : 246.47 g/mol

Synonym : Epsom Salt

Method of Preparation

It is obtained by the action of dilute sulphuric acid (H_2SO_4) and magnesium carbonate ($MgCO_3$)



Properties

- It occurs as white crystals
- It is odourless
- It having a cool, saline, bitter taste
- It is soluble in water and sparingly soluble in alcohol.

Uses

- It is used as cathartics.
- It is used in agriculture.
- It is used to control seizures in pregnancy.

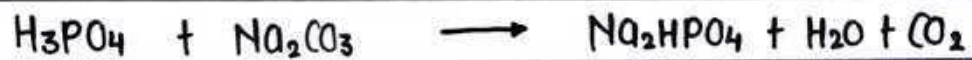
Sodium Orthophosphate

Chemical Formula : $\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$

Molecular Weight : 358.14 g/mol

Preparation

It is obtained by adding sodium carbonate to a hot solution of phosphoric acid.



Properties

- It occurs as colourless crystals
- It is odourless
- It having a saline taste
- It is soluble in water
- It is insoluble in alcohol

Uses

- It is used as cathartics
- It is also used as buffers.

Kaolin

Molecular / Chemical Formula : $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$

Molecular Weight : 258.16 g/mol

Synonym : China Clay

Preparation

It is simply prepared from natural clay by powdering, separating and purifying process.

Properties

- It is light, white powder.
- It is odourless
- It is tasteless

Uses

- It is used as cathartics
- It is used in food poisoning
- It is used in dusting powders.

Bentonite

Chemical Formula : $\text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$

Molecular Weight : 360.31 g/mol

Synonym : Clay

Preparation

It occurs naturally or can be prepared from natural clay

Properties

- It occurs as very fine, cream-colour powder
- It is odourless.
- It is insoluble in water.

Uses

- It is used as cathartics.
- It is used as emulsifier.
- It is also used as protectives.

ANTIMICROBIAL AGENTS

- Antimicrobial agents are those chemical compounds or drugs that inhibits or destroys the growth of microorganism
- They can either kill or prevents the growth of bacteria.

Classification of Antimicrobials

- ① Antiseptic
- ② Disinfectants
- ③ Germicides
- ④ Bacteriostatics
- ⑤ Sanitizers
- ⑥ Sterilization

Antiseptic

- Antiseptic are those antimicrobial agents that are mainly used on living cells.
- They either kills or inhibits the growth of bacteria.
- An ideal antiseptic agent should destroy bacteria, viruses etc and should not cause any harm to applied area.
- example : Hydrogen Peroxide, Silver nitrate etc.

Disinfectant

- These are the antimicrobial agents that are mainly used on Non-Living surfaces.
- They can either kill or destroy bacteria.
- They are mainly used in home and hospital cleaning.
- example : Sulphur dioxide

Germicides

- These are the agents that are used to kill microorganism.
- They can be either use on Living or Non-living surfaces.
- They can also be divided into following types :

Bactericides : To kill bacteria

Virucides : To kill viruses

Fungicides : To kill fungi

Bacteriostatics

- These are the agents that are used to prevent the growth of bacteria.
- They do not kill bacteria
- Can be used on living or Non-living surfaces.
- example : Chloramphenicol

Sanitizers

- Sanitizers are agents that are mainly used in cleaning & washing.
- They are generally used to maintain general public health standards.
- example : Soap, Alcohol etc.

Sterilization

- It is a process by which all the microorganism are either killed or removed.
- In this process, the products, surface or area will be free from all type of microorganism.

Mechanism of action of Antimicrobials

- Microorganism mainly contains proteins (enzymes) to survive.
- Anti-microbials act by changing their protein structure which results in death of microorganism.
- Antimicrobials mainly act by 3 mechanism:
 - ① Oxidation
 - ② Halogenation
 - ③ Precipitation

Oxidation

- This MOA shows by oxygen releasing compounds.
- They cause oxidation of active functional groups present in proteins and inactivate them.

Halogenation

- This MOA shows by halogen (Br, Cl etc) releasing compounds.
- These agents add halide atom to nitrogen present at peptide linkage of protein & inactivates them.

Precipitation

- This MOA shows by Metal containing compounds.
- Metal binds with important group present in protein change their structure & inactivates them.



POTASSIUM PERMANGANATE

Chemical Formula : KMnO_4

Molecular Weight : 158 g/mol

Synonym : Condy's Crystals

Preparation

It can be easily prepared by from potassium manganate under acidic condition



Properties

- It is purple crystalline solid.
- It is odourless.
- It is soluble in both water and alcohol.

Uses

- It is used as antimicrobial agents.
- It is used in treatment of various skin conditions.
- It is used as antiseptic
- It is used as strong oxidizing agent.

BORIC ACID

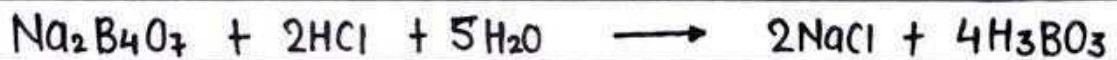
Chemical Formula : H_3BO_3

Molecular Weight : 61.83 g/mol

Synonym : Hydrogen Borate

Preparation

It is prepared by the action of HCl on borax ($Na_2B_4O_7$)



Properties

- It is white crystalline solid
- It is odourless
- It having sweet taste.
- It is soluble in water & slightly soluble in alcohol.

Uses

- It is used as anti-microbial agents.
- It is used as preservatives.
- It is also used in cosmetics.

HYDROGEN PEROXIDE

Chemical Formula : H_2O_2

Molecular Weight : 34.01 g/mol

Synonyms : Hydrogen Oxide , Peroxide

Preparation

It can be prepared by the reaction of sodium peroxide with dilute sulphuric acid



Properties

- It is clear colourless liquid.
- It is odourless.
- It having a bitter taste.
- It is miscible with water.

Uses

- It is used as antimicrobial agent.
- It is used as antiseptic.
- It is used as bleaching agent.
- Also used in tooth whitening.

CHLORINATED LIME

<u>Chemical Formula</u>	Ca(OCl)₂ CaOCl ₂
<u>Molecular Weight</u>	142.98 g/mol 136.98 g/mol
<u>Synonym</u>	Bleaching Powder

Preparation

It is prepared by reacting chlorine with calcium hydroxide



Properties

- It is white or grey powder.
- It has odour of chlorine.
- It is partially soluble in water and alcohol.

Uses

- It is used as antimicrobial agent.
- It is used as powerful bleaching agent.

IODINE

Chemical Formula : I_2

Molecular Weight : 253.8 g/mol

Synonym : Halogens

Preparation

In laboratory, it is prepared by heating the mixture of KI, MnO_2 and concentrated H_2SO_4 .



Properties

- It occurs as greyish-violet or bluish-black crystals.
- It has strong harsh odour.
- It is volatile in nature.
- It is insoluble in water.
- It is soluble in alcohol.

Uses

- It is used as antimicrobial agent.
- It is used in iodine deficiency.
- It is used in thyroid cancer.