Program	:	B. Pharmacy
Semester	:	1st
Subject /Course	:	Pharmaceutical Inorganic Chemistry/ B. Pharmacy
Subject/Course ID	:	Pharmaceutical Inorganic Chemistry/ BP104T
Module No.	:	03
Module Title	:	Gastrointestinal Agents
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Learning Outcome of Module-3

LO	Particular	Course outcome
1.	To gain knowledge about acidifiers, antacids, cathartics and antimicrobial agents.	BP 104.3
2.	To justify the medicinal importance of acidifiers, antacids, cathartics and antimicrobial agents as gastrointestinal agents.	BP 104.3

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Module Content Table

No.	Topic
1.	General introduction of Gastrointestinal agents.
2.	Acidifiers
3.	Antacids
4.	Cathartics
5.	Antimicrobial agents

GASTROINTESTINAL AGENTS

The gastrointestinal tract or digestive tract also referred as the GI tract or the alimentary canal. Gastrointestinal System is responsible for the breakdown and absorption of various foods and liquids needs to sustain life. GI tract starts with the mouth and proceeds to the esophagus, stomach, small intestine (duodenum, jejunum, ileum), and then to the large intestine (colon), rectum, and terminates at the anus.

The gastrointestinal agents includes:

1. Acidifying Agents or Acidifiers
2. Antacids
3. Protective and Adsorbents
4. Saline Cathartics.

ACIDIFYING AGENTS OR ACIDIFIERS

Acidifying agents are the inorganic chemical substances that either produce or increase acid. These chemicals increase the level of gastric acid in the stomach when ingested, thereby increasing the stomach pH. It is broadly classified into four categories:-

1. Gastric Acidifiers: These are the drugs which are used to increase the acidity of the stomach in patients suffering from Achlorhydria or Hypochlorhydria (absence or insufficient quantity of HCl acid in the gastric secretion). It responds to stimulation by histamine.

The Achlorhydria patients are of two types:

i) Those who do not respond to histamine phosphate stimulation for the release of HCl.

ii) Those who respond to histamine phosphate stimulation for the release of HCl in the stomach.

In either of the cases, the G.I. disturbances i.e. frequent bowel movement, mild dharrhoea, epigastric pain and sensitivity to spicy foods are the common symptoms. It is used to control the pH of the acidic stomach (pH 1.5-3.5). This condition is best treated by the administration of HCl acid.

2. Urinary Acidifiers: These are the drugs which are used to remove acidic urine from the body

or to maintain the pH of the urine. These acidifiers are widely used to cure some types of urinary tract infections.

For example: Many bacterias are grown badly in acidic urine as far as urine is concerned. Hexamine only acts as antiseptic when the urine is acidic. In acidic media, hexamine itself break up into ammonia and formaldehyde.

3. Systemic acidifiers: These are the drugs which are able to neutralise the alkaline body fluids, especially blood or to maintain the pH of all parts of the body. It is used to treat patients suffering from systemic alkalosis.

4. Acid: These are used as pharmaceutical aids in the preparation of medicaments, laboratory quality control.

HYDROCHLORIC ACID

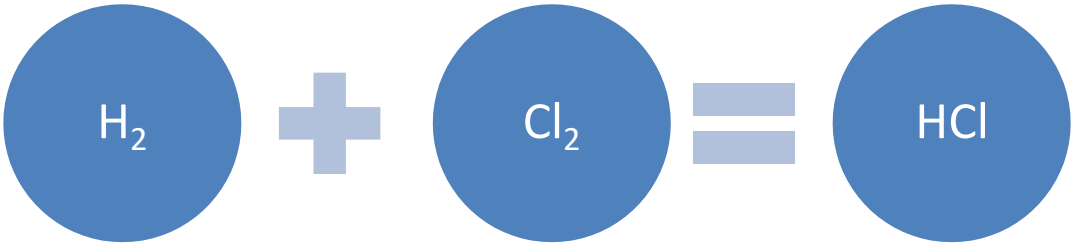
Molecular formula: HCl

Molecular Weight: 36.46

Synonym: Spirit of Salt, Muriatic acid

Preparation: It can be prepared by the action of concentrated Sulphuric acid on Sodium Chloride and passing the liberated Hydrogen Chloride through water.

In this method, the hydrogen and chlorine obtained in the electrolysis of sodium chloride in the manufacture of caustic soda are burnt, preferably using quartz bunsen burners.



100% pure HCl is formed in this method.

Properties: It is nearly colourless clear and fuming liquid.

- It possesses pungent odour.
- It is soluble with water and alcohol.
- It is a strong acid and attacks metals, forming the hydrochlorides with the evolution gas.

Chemical Properties: It reacts with Sodium metal which results in the formation of sodium chloride and liberates hydrogen gas.

$2Na + 2HCl \longrightarrow 2NaCI + H_2$

- It is oxidised by strong oxidising agents liberating chlorine gas

$2KMnO_4 + 16HCl \longrightarrow 2MnCl_2 + 2KCI + 8H_2O + 5C1_2$

Storage: It is stored in well closed container of glass or other inert material at temperature not exceeding 30˚C

Uses: It is used as a Pharmaceutical Aid.

- It is also employed as an acidifying agent or acidifier.

- It is also used to inactivate the proteolytic enzyme, pepsin. Certain antacids like Sodium Bicarbonate which are water soluble may raise it pi above 7. The continual hyperacidity may lead to peptic or duodenal ulcer.

AMMONIUM CHLORIDE

Molecular Weight: 53.9

Molecular formula: NH_4Cl

Ammonium chloride contains not less than 99.5% of NH_4Cl, calculated with reference to substance dried over silica gel for 4 hours.

Preparation:

1) It is prepared by purifying the crude product by sublimation or by boiling ammonium sulphate solution with sodium chloride in the equivalent proportions.

2) Neutrlaization of HCl acid with ammonia and evaporation of solution to dryness yield ammonium chloride.

Properties: It is white, fine or coarse crystalline powder.

- It is having a cooling saline taste.
- It is odourless.
- It is sligthly hygroscopic.
- It is soluble in 2.6 parts of H_2O, 1.4 parts of boiling water & 100 parts of alcohol.

Assay:

Weigh accurately about 0.2g sample

↓

dissolve in 40ml of H_2O

add 3 ml of Nitric acid, 5 ml of Nitrobenzene & 50 ml of 0.1N Silver nitrate, shake vigorously

for 1 minute

titrate with 0.1N ammoniunm thiocyanate using 2ml of solution of ferric ammonium sulphate as indicator.

Each ml of 0.1N silver nitrate is equivalent to 0.005349g of NH_4Cl.

Uses: It is used as an expectorant.

- It is used as a diuretic &e systemic acidifying agent.
- It is used to maintain the urine at acid pH in the treatment of some UTI disorders.

ANTACIDS

Antacids are the substance which are used to neutralise the gastric acidity. Acidity occurs due to excessive secretion of HCl in stomach due to various reasons. They produce sympathomimetic relief from pain, heart burns or by neutralizing the excess of hydrochloric acid.

Peptic ulcers occur due to defective oesophageal sphincter as hiatal hernia. Gastric ulcers occur in lesser curvature and are found in first portion of duodenum.

The neutralizing capacity of an antacid is expressed in milliequivalents (mEq) of hydrochloric acid. Every antacid may have a total neutralizing capacity of atleast 5 mEq of HCl per dosage unit.

Antacids raise the pH of the gastric contents to above 3.5.

Antacids may be classified as

1. Systemic (absorable) antacids: These are soluble, readily absorable and capable of producing systemic electrolytic alterations and alkalosis. Example: Sodium Bicarboante.
2. Non-systemic (Non-absorable) antacids: These are not absorbed to a significant extent and thus do not exert an appreciable systemic effects e.g. Aluminium salts, Magnesium salts and Calcium Carbonate.

Ideal Characteristics of Antacids:

1. The antacid should not be absorbable or cause systemic alkalosis.

2. The antacid should not be a laxative or cause constipation.
3. The antacid should exert its effect rapidly and over a long period of time.
4. The antacid should have buffer in the pH range of 4-6.
5. The reaction of the antacid with gastric hydrochloric acid should not cause a large evolution of the acid
6. The antacid should Probably inhibit Pepsin.

SODIUM BICARBONATE

Molecular Weight: 84.01

Molecular formula: $NaHCO_3$

Synonyms: Sodium Hydrogen Carbonate, Baking Soda, Mitha Soda.

It is highly water soluble antacid with a very rapid onset of action but relatively short duration.

Preparations: On small scale, it is prepared by passing CO_2 gas through a solution of sodium hydroxide.

$$2NaOH + CO_2 \longrightarrow Na_2CO_3 + H_2O$$

$$Na_2CO, + H_2O + CO_2 \longrightarrow 2NaHCO_3$$

2. Solvay Process (Ammonia Soda Process): Strong solution of Sodium Chloride containing a high concentration of ammonia is passed through a carbonating tower where it is saturated with CO_2 gas under pressure.

$$NH_3 + CO_2 + H_2O \longrightarrow NH_4HCO_3$$

$$NH_4HCO_3 + NaCl \longrightarrow NaHCO_3 + NH_4Cl$$

Ammonia and Carbon Dioxide react to form Ammonium Bicarbonate which further undergo decomposition to form Sodium Bicarbonate.

It is specific in the treatment of systemic acidosis.

Properties: It ocurs as white crystalline or amorphous powder.

- It is having a saline taste.
- Its solution is alkaline in nature.
- It is freely soluble with water but practically insoluble in alcohol.

Assay:

Weigh accurately about 0.6gm of sodium carbonate, previously dried

Dissolved in 50ml of water

Titrate with 0.5ml HCl using bromophenol blue as indicator.

Uses: It is mainly used as electrolyte Replenisher.

- It is mainly used for its Acid Neutralizing properties.
- It is also find used as an antacid.
- It is used as local applicant for burns, insect bites etc.

ALUMINIUM HYDROXIDE GEL

Chemical formula: $Al(OH)_3$

Molecular Weight: 77.99

Synonym: Aluminium Hydroxide Powder, Aluminium Hydrated Powder

It can be recognized into two ways

(a) Aluminium Hydroxide Gel

(b) Dried Aluminium Hydroxide Gel

(a) Aluminium Hydroxide Gel: It is white viscous suspension of Hydrated Aluminium Oxide

with varying amount of basic Aluminium Carbonate. It gets separated into the clear 1iquid on standing for sometime. It exhibits suitable flavouring and antimicrobial agent. It has a pH between 5.5 and 8.0

Preparation: When an Aluminium Salt such as Aluminium Chloride is treated with Ammonia or Sodium Carbonate, a white gelatinous precipitate of aluminium hydroxide is obtained.

$AICl_3 + 3NH_4OH \longrightarrow Al(OH)_3 + 3NH_4Cl$

$Al(OH)_3 + 3NaOH \longrightarrow Na_3AlO_3 + 3H_2O$

After complete removal of CO_2 the precipitate Aluminium Hydroxide is filtered, washed throughly with hot water untill it become free from sulphates ions. The precipitate may be suspended in the purified water to strengthen aluminium hydroxide gel.

b) Dried Aluminium Hydroxide Gel

Synonyms: Aluminium Hydroxide powder.

Properties: It is not a typical gel but is a white, odorless, tasteless, amorphous powder.

- It is insoluble in water and alcohol but soluble in dilute mineral acids & solution of fixed Alkali Hydroxides.
- It forms gel on prolonged contact with water.
- It absorbs certain acids and CO_2.
- It has a pH between 5.5-8.0.

One major drawback of gel is that of a loss of antacid properties on aging

Storage:

It should not be stored at a temperature not exceeding 25˚C and should be stored in air tight containers.

MAGNESIUM HYDROXIDE

Chemical formula: $Mg(OH)_2$

Molecular Weight: 58.31

Synonym: Milk of magnesia

Preparation: It is prepared by combining a solution of many magnesium salts with basic water induces precipitation of solid magnesium hydroxide.

$Mg^{2+} + OH^- \longrightarrow Mg(OH)_2$

On a commercial scale, magnesium hydroxide is prepared by treating seawater with lime calcium hydroxide.

$Mg^{2+} + Ca(OH)_2 \longrightarrow Mg(OH)_2 + Ca^{2+}$

Properties: It occurs as white, odourless powder.

- It is soluble in dilute acids and practically insoluble in ethanol and water.

Uses: It is used as a laxative to relieve constipation.

- It is also used to treat gastrointestinal ailments such as heartburn or feelings of indigestion.

SALINE CATHARTICS

Cathartics may be defined as those drugs which are used to bring about defecation i.e. emptying of the stomach.
Cathartics are used to:

- To relieve from acute constipation.
- To ease in defecation of patients suffering from harmful haemorrhoids or other rectal disorders.
- To clear bowels from stomach before surgery.

Laxatives are mild Cathartics while Purgatives are used for strong Cathartics. They act both by retaining fluids in bowel. They should not be used on regular basis because they can cause water and electrolyte imbalance.
Stimulants, Bulk forming, Emollients and Saline cathartics are the four types of laxatives.
They may be administrated either by oral route or by rectal route.
Inorganic compounds such as Sodium Potassium tartrate and Magnesium Sulphate widely used

as Saline cathartics.

Classification: Laxatives can be conveniently classified into five classes:

1. Stimulant Laxatives: These act on the intestinal tract to increase its motor activity e.g. phenolphthalein, castor oil.

2. Saline Laxative: A number of magnesium salt as well as sulphate, phosphate and tartartes are used as saline cathartics/laxatives. These cations and anions are not absorbed or slightly absorbed from the gastro intestinal tract.

3. Bulk forming laxatives: These include natural and semisynthetic polysaccharides and cellular derivatives that are are only partially digested. The undigested portion is hydrophilic & swells in presence of water or viscous gel.

4. Lubricant laxativs: These drugs lubricates the intestinal tract, soften the faecal contents and lubricate the passage of feces.

5. Pecal softeners: Substance in this category are wetting agents e.g docusate sodium which are non-absorbable & relatively non-toxic.

Mode of action: The saline cathartics are act by increasing the osmotic load of GIT. These cathartics are salts of poorly soluble anions and cations. The body relieves hypertonicity of the gut by secreting additional fluid into the intestinal tract. This result in increased bulk in GIT. The resulting increasing bulk stimulates peristalsis. The saline cathartics are water soluble and are taken with large amounts of water.

MAGNESIUM SULPHATE

Molecular Formula: $MgSO_4 7H_2O$

Molecular Weight: 246.5

Synonyms: Epsom salt, Magnesium sulphate

Method of Preparation: It is obtained by the action of dilute Sulphuric Acid on Magnesium Carbonate or Magnesium Oxide. The solution obtained is filtered off and then evaporated to crystallisation.

$$MgCO_3 + H_2SO_4 \longrightarrow MgSO_4 + H_2O + CO_2$$

$$MgO + H_2SO_4 \longrightarrow MgSO_4 + H_2O$$

Properties: It occurs as odourless, brillant, colourless crystals or white crystalline powder.

- It is having a bitter saline and cooling taste.

- It efflorescenes in warm dry air.
- It is soluble in water and sparingly soluble in alcohol.

Storage: It should be stored in a well closed container because of its efforvescent nature

Uses: It acts as a saline laxative.

- It is also used in the treatment of magnesium deficiency, hypertension and boils.

SODIUM ORTHOPHOSPHATE

Molecular weight: 358.14

Molecular formula: $Na_2HPO_4.12H_20$

Synonymns: Phosphor soda

Method of Preparation: It is prepared by reaction of Orthophosphoric Acid with Sodium Hydroxide.

$2NaOH + H_3PO_4 \quad Na_2HPO_4 + 2H_2O$

- From bone ashes or mineral phosphorite, which is then treated with Sulphuric Acid.

Properties: It is colourless, odorless, and crystalline powder.

- It is efflorescent.
- It is soluble in water and practically insoluble in alcohol.

Uses: It is used as a Pharmaceutical Aid and as a Saline Carthatic.

- It is used as a Buffering Agent.

BENTONITE

Chemical Formula: $Al_2O_34SiO_2.H_2O$

Synonym: Clay

It is a natural, colloidal, and an absorbent aluminium phyllosilicate consisting mostly of montmorillonite, $Al_2O_34SiO_2.H_2O$. It may also contain magnesium, calcium and iron. Volclay

bentonite is its most common type composed of about 90% montmorillonite [$Al_2Si_4O_{10}(OH)_2.nH_2O$]. Other components such as feldspar [$K_2OAl_2O_36SiO_2J$ and aluminosilicate containing Al_2O_3, CaO, SiO_2, MgO and some K and Na.

Properties: It occurs as very fine odourless, cream coloured to greyish powder white.

- It is slightly earthy in taste. It is insoluble in water but soluble in organic solvents.

Storage: It is stored in tightly closed containers

Uses: It is used as filler in pharmaceuticals, and due to its absorption/adsorption functions, it allows paste function.

- It is used as suspending agent.

KAOLIN

Chemical Formula: $Al_2O_32SiO_2.2H_2O$

Synonym: China Clay

Kaolin (China clay) is purified, natural, hydrated aluminium silicate of variable composition. It is derived from the decomposition of feld spar of granitic rocks. Kaolin consists of aluminium silicate with traces of compound of magnesium, calcium and iron.

Preparation: kaolin is prepared when rock is mined, excavated and the impurities are washed with water and then powdered. The rock is elutriated with water and large-sized particles are separated. The turbid liquid is allowed to settle, heavy kaolin containing the large particles and colloidal kaolin containing particles of small size are separated & dried.

Properties: Kaolin has an earthy or clay-like taste. Its colour may be tinged grey, yellow brown, blue or red due to impurities. It is unctuous & soapy to touch. It is not affected by dil. HCl or HNO_3 acid but is decomposed by the prolonged boiling or treatment with concentrated H_2SO_4.

Heavy Kaolin

- It is purified natural form or variable composition. Its particles are 20 um in diameter, flat 7 irregularly arranged.
- With water plastic-like form is obtained which is less sticky.
- It is fine white or greyish-white earthy mass or powder. It is practically insoluble in water & in organic solvents.
- When the aqueous. suspension is kept for sometime, the whole Kaolin settles below leaving clear supernatant liquid.

Light Kaolin

- It is a native form, freed from most of its impurities by elutriation & dried. It contains a suitable dispensing agent. The particles are small, less than 2um in diameter & have various shape & size.
- Natural light Kaolin is a Kaolin which does not contain a dispensing agent.

Uses: Kaolins are adsorbent, anti-diarrhoeal and when given by mouth.

- Light Kaolin is used as a dusting powder food additive.
- They are employed in the sympathomatic treatment of diarrhoea & to coat irritated intestinal mucosa in case of diarrhoea.

ANTIMICROBIAL AGENTS

An antimicrobial (disinfectant and antiseptic) is a substance that kills or inhibits the growth of microorganisms such as bacteria, fungi or protozoans. Antimicrobial drugs either kill microbes (microbiocidal) or prevent the growth of microbes (microbiostatic). Specific terminology describes exact mode or mechanism of action.

1. Antiseptics: Antiseptic is a substance that prevents or arrests the growth of a microorganisms. It acts by inhibiting their activity or destroying them especially of agents applied to living tissue like surface of skin, application of antiseptic dressing on wounds. The drugs like phenol, iodine, boric acid, cetrimide are the example of antiseptics.

2. Disinfectants: These are the drugs or substances used either to kill bacteria or prevent their growth or multiplication. It is used on non living objects or outside the body. For example: Disinfection of surgical instruments, sputum and urine containers on floor. Commonly used as disinfectants includes cresol, phenol.

3. Germicides: These are the substances which kill microorganisms. They act by oxidation of bacterial protoplasm, by denaturation or bacterlal enzymes and protein by increasing permeability of bacterial cell membrane. Potency of germicide is expressed by Phenol Coefficient. Specific terminology like bacteriocide (against bacteria), fungicide (against fungi), virucide (against Virus) etc. denotes exact action.

4. Bacteriostatics: These are the substances which primarily function by inhibiting the growth of

bacteria. Thus, bacteriostatic drugs or agents do not kill but arrest growth of bacteria.

5. Sanitizers: Sanitizer is the process of rendering sanitary by reducing the number of bacterial contaminants. These are used to maintain general public health standard. Santization can be

achieved only with surfaces and articles that are physically clean in addition to possess low bacterial counts or that are free from most vegetative microbes. High conc. of sanitizers also cause local cellular damage.

Inorganic compounds generally exhibit antimicrobial action by involving either of the following three mechanisms:

i) Oxidation

ii) Halogenation

iii) Protein precipitation.

BORIC ACID

Chemical Formula: H_3BO_3

Molecular Weight: 61.83

Synonyms: Hydrogen borate, boracic acid, orthoboric acid, acidum boricum.

It is widely distributed in sea water, plants and fruits. It is also available in the combined form as its largest natural source.

Method of Preparation: It is prepared by reacting hydrochloric or sulphuric acid with the native borax. The solution is filtered. The crystals obtained are washed and then allowed to dry at room temperature.

Properties: It occurs as colourless or white crystals.

- It is slightly soluble in water and in alcohol.
- It is odourless with slightly acidic and bitter taste.
- On heating, it decomposes to form metaboric acid HBO_2.

Uses: Boric acid can be used as an antiseptic for minor burns or cuts.

- It is used in dressings.
- It is applied in a very dilute solution as an eye wash.
- As an antibacterial or antimicrobial compound, it can also be used as an acne treatment.

HYDROGEN PEROXIDE

Chemical Formula: H_2O_2

Molecular Weight: 34.016

It is an aqueous solution of hydrogen peroxide. It is having not less than 6% w/w of H_2O_2 which corresponds to about 20 times its volume of available oxygen.
It was discovered by French chemist Thenard.

Methods of Preparation: In laboratory, it is prepared by Merck's process. It is prepared by adding calculated amounts of sodium peroxide to ice cold dilute (20%) solution of H_2SO_4.

$Na_2O_2 + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O_2$

- On commercial scale, H_2O_2 can be prepared by the electrolysis of 50% H_2SO_4 solution. In a cell, peroxy sulphuric acid is formed at the anode.

$2H_2SO_4 \longrightarrow H_2S_2O_8(aq.) + H_2$

Properties: Hydrogen peroxide is clear, colourless syrupy liquid.

- It is odourless or may have an odour resembling to that of ozone unstable liquid.
- It is a strong Oxidizing agent.
- It is soluble with water from which it can be extracted with solvent ether.
- It rapidly decomposes in contact with oxidizable organic matter and with metals.

Assay: The assay is done on the basis of the oxidation reduction reaction.

↓

Dilute 10ml of the sample in 250ml volumetric flask with distilled water
To 25ml of this solution add 10ml of 5N sulphuric acid

↓

Titrate against 0.1N potassium permanganate solution until a faint pink color appears.

Each 1ml of 1N permanganate = 0.01701g of H_2O_2

Storage: It is not stored in glass bottles since the alkali metal oxides present in glass catalyse its decomposition. It is stored in paraffin wax coated with glass, plastic or teflon bottles.

Uses: It acts as an antiseptic and a germicide and hence is used for cleaning cuts and wounds.

- It is used for bleaching delicate articles like wool, hair, feather, ivory etc.
- It is used as an aerating agents in production of spong rubber.
- It is used as an antichlor.
- It finds use in deodorants.
- It is also used for cleaning ears and removing the surgical dressing.
- It is an effective antidote for phosphorous and cyanide poisoning.

POTASSIUM PERMANGANATE

Chemical Formula: $KMnO_4$

Molecular Weight: 158.03

It is an inorganic chemical compound having not less than 99.0% of $KMnO_4$ Formerly known as Permanganate of Potash or Candy's Crystals.

Method of Preparation: On large scale, it is prepared by mixing a solution of KOH with powdered manganese oxide and potassium chlorate in the presence of air or an oxidizing agent.

$$2KOH + MnO_2 + KClO_3 \longrightarrow K_2MnO_4 + KCl + H_2O$$

Potassium manganate so formed is extracted along with boiling water and a current of chlorine, CO_2 or ozonised air is passed into the liquid untill it gets converted to permanganate. The MnO_2 formed is removed.

$$K_2MnO_4 + 3Cl_2 \longrightarrow 6KMnO_4 + 6KCl$$

When carbon dioxide is passed through the chlorine solution, manganate gets converted into $KMnO_4$.

$$3K_2MnO_4 + 2CO_2 \longrightarrow 2KMnO_4 + MnO_2 + 2K_2CO_3$$

Properties: It occurs as odourless dark purple or almost black prismatic crystals or granular powder.

- It has a sweet and astringent taste.
- It decomposes with a risk of explosion, in contact with certain organic substances.
- It has a specific gravity of about 2.703.
- It is stable in air.

- It is soluble in water.

Uses: It finds use in the treatment of urethritis.

- It possesses Oxidizing properties and oxidizes proteins and other bioorganic substance.
- It has the capability to destroy the poison and prevents absorption.
- Its solutions are used to clean the ulcer or abscesses, as wet dressings and in baths in eczematous condition.
- It finds use as an antidote in the case of poisoning by barbiturates, chloral hydrate and many alkaloids.

CHLORINATED LIME OR BLEACHING POWDER

Chemical Formula: $Ca(CIO)_2$

Molecular Weight: 136.98

Synonyms: Bleaching powder, chloride of lime.

Method of Preparation: It is prepared by the chlorination of slaked lime.

$$2Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 + CaCl_2 + 2H_2O$$

It is usually a mixture of calcium hypochlorite ($Ca(OCI)_2$) and calcium chloride with some slaked lime

Properties: It is dull white powder with characteristic odour.

- It is slightly soluble in water and in alcohol.
- On exposure to air, it becomes moist and gradually decomposes with the lose of chlorine.
- Its aqueous solution is strongly alkaline.
- It is able to oxidize many salts such manganous salts to permanganate. Carbon dioxide gets absorbed and chlorine is evolved.

Assay:

Accurately weigh sample and dissolve in water

Transferred into iodine flask and then treated with excess of potassium iodide acidified with 5ml

of acetic acid

Shake for 2-3 minutes and set aside for 15 minutes

Titrate with 0.1N sodium thiosulphate solution using starch solution as indicator till the deep iodine colour changes to yellow colour.

Each ml of 0.1N sodium thiosulphate = 0.003545 g of available chlorine.

Uses: It is also used as an ingredient in bleaching powder, used for bleaching cotton and linen.

- It is also used in sugar industry for bleaching sugar-cane juice before its crystallization.
- It is used as a sanitizer in outdoor swimming pools in combination with a cyanuric acid stabilizer which reduces the loss of chlorine due to ultraviolet radiation.
- It has the bactericidal action.

IODINE

Chemical Formula: I_2

Molecular Weight: 253.8

Iodine is a dark violet non-metallic halogen element.

Method of Preparation: Iodine is manufactured by extracting kelp (sea weed's ash) with water. The solution is concentrated when the sulphate and chloride of sodium and potassium get crystallized out, leaving freely soluble sodium and potassium iodides in the mother liquor. Sulphuric acid is added to the mother liquor which then gets decanted off.

$$2NaI + 3H_2SO_4 + MnO_2 \longrightarrow MnO_4 + 2NaHSO_4 + 2H_2O$$

In the laboratory, it reacts by heating potassium iodide or sodium iodide with dilute sulphuric acid and manganese dioxide.

$2KI + 3H_2SO_4 + MnO_2 \rightarrow 2KHSO_4 + I_2 + MnSO_4 + 2H_2O$

Properties: It occurs as heavy, bluish-black or greyish violet brittle plates with a metallic lusture.

- It is very slightly soluble in alcohol, chloroform and slightly soluble in concentrated solutions of iodides, carbon disulphide, solvent ether, carbon tetrachloride, chloroform, give violet solutions.

Uses: It is used as an anti-hyperthyroid.

- It is used in the manufacture of dye stuffs and drugs.
- It is used as a reagent in analytical chemistry.
- It is used in the manufacture of compounds used in photography.

Prolonged use of iodine may produce metallic taste, increased salivation, burning pain. It can give rise to allergic reactions also.

POVIDONE-IODINE (PV-I)

It is a stable chemical complex of Polyvinyl Pyrrolidone (povidone, PVP) and Elemental Iodine. It contains 9.0% to 12.0% available iodine, calculated on a dry basis. It belongs to iodophors class of compounds.

Properties: It is having a slight characteristic odour.

- It is a yellowish brown amorphous powder.
- It is soluble in water and alcohol but practically insoluble in organic solvents. It is acidic litmus.

Uses: It has a broad spectrum antiseptic for topical application in the treatment and prevention of infection in wounds.

- It is used as a disinfectant.
- It is also used as gargles and mouthwashes for the treatment of infections in the oral cavity.

MULTIPLE CHOICE QUESTIONS

1. Acidifiers are those agents which?

a. Increase acidity

b. Decrease acidity
c. Both a and b
d. None of these

2. Antacids are those agents which?

a. Increase acidity
b. Decrease acidity
c. Both a and b
d. None of these

3. Cathartics are those agents which used to treat?

a. Acidity
b. Constipation
c. Both a and b
d. None of these

4. Antacids are classified into how many classes?

a. One
b. Two
c. Four
d. None of these

5. Systemic antacids are?

a. Nonabsorbable
b. Absorbable
c. Both a and b
d. None of these

6. Purgatives are?

a. Strong cathartics

b. Mild cathartics

c. Both a & b
d. None of these

7. Laxatives are?

a. Strong cathartics
b. Mild cathartics
c. Both a & b
d. None of these

8. Antimicrobial agents are classified into how many classes?

a. One
b. Five
c. Three
d. None of these

9. Phenol & cresol are examples of?

a. Antiseptic
b. Disinfectant
c. Sanitizer
d. Germicides

10. Antimicrobial agents acts by?

a. Oxidation
b. Protein precipitation
c. Halogenation
d. All of above

LONG ANSWER QUESTIONS

Explain in detail about Acidifying reagents or Acidifiers?

Ans. Acidifying agents are the inorganic chemical substances that either produce or increase acid. These chemicals increase the level of gastric acid in the stomach when ingested, thereby increasing the stomach pH. It is broadly classified into four categories:-

1. Gastric Acidifiers: These are the drugs which are used to increase the acidity of the stomach in patients suffering from Achlorhydria or Hypochlorhydria (absence or insufficient quantity of HCl acid in the gastric secretion). It responds to stimulation by histamine.

The Achlorhydria patients are of two types:

i) Those who do not respond to histamine phosphate stimulation for the release of HCl.

ii) Those who respond to histamine phosphate stimulation for the release of HCl in the stomach.

In either of the cases, the G.I. disturbances i.e. frequent bowel movement, mild dharrhoea, epigastric pain and sensitivity to spicy foods are the common symptoms. It is used to control the pH of the acidic stomach (pH 1.5-3.5). This condition is best treated by the administration of HCl acid.

2. Urinary Acidifiers: These are the drugs which are used to remove acidic urine from the body or to maintain the pH of the urine. These acidifiers are widely used to cure some types of urinary tract infections.

For example: Many bacterias are grown badly in acidic urine as far as urine is concerned. Hexamine only acts as antiseptic when the urine is acidic. In acidic media, hexamine itself break up into ammonia and formaldehyde.

3. Systemic acidifiers: These are the drugs which are able to neutralise the alkaline body fluids, especially blood or to maintain the pH of all parts of the body. It is used to treat patients suffering from systemic alkalosis.

4. Acid: These are used as pharmaceutical aids in the preparation of medicaments, laboratory quality control.

Describe in detail the method of preparation, Properties and uses of Hydrochloric acid?

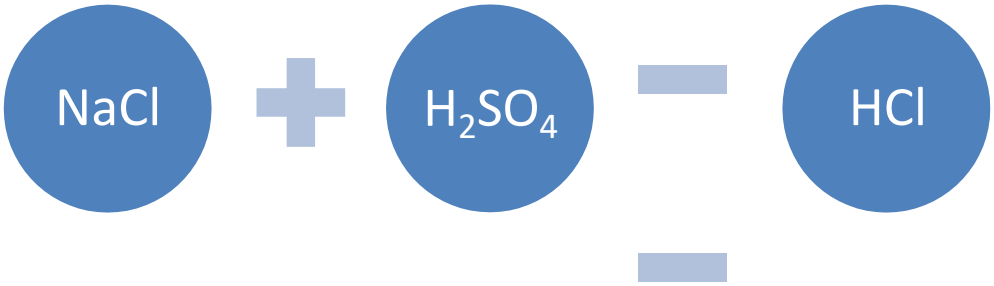
Ans. HYDROCHLORIC ACID

Molecular formula: HCl

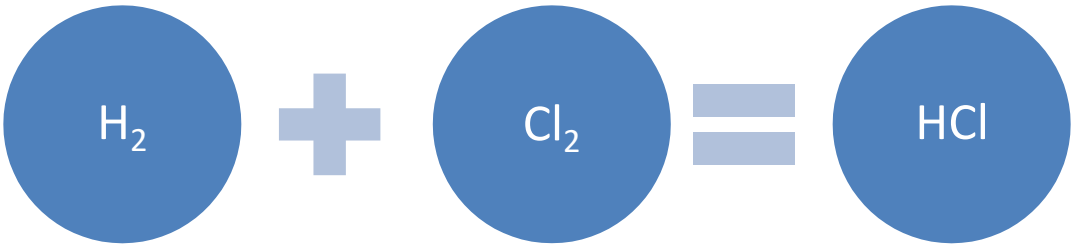
Molecular Weight: 36.46

Synonym: Spirit of Salt, Muriatic acid

Preparation: It can be prepared by the action of concentrated Sulphuric acid on Sodium Chloride and passing the liberated Hydrogen Chloride through water.



In this method, the hydrogen and chlorine obtained in the electrolysis of sodium chloride in the manufacture of caustic soda are burnt, preferably using quartz bunsen burners.



100% pure HCl is formed in this method.

Properties: It is nearly colourless clear and fuming liquid.

- It possesses pungent odour.
- It is soluble with water and alcohol.
- It is a strong acid and attacks metals, forming the hydrochlorides with the evolution gas.

Chemical Properties: It reacts with Sodium metal which results in the formation of sodium chloride and liberates hydrogen gas.

$2Na + 2HCl \longrightarrow 2NaCI + H_2$

- It is oxidised by strong oxidising agents liberating chlorine gas

$2KMnO_4 + 16HCl \longrightarrow 2MnCl_2 + 2KCI + 8H_2O + 5C1_2$

Storage: It is stored in well closed container of glass or other inert material at temperature not exceeding 30˚C

Uses: It is used as a Pharmaceutical Aid.

- It is also employed as an acidifying agent or acidifier.
- It is also used to inactivate the proteolytic enzyme, pepsin. Certain antacids like Sodium Bicarbonate which are water soluble may raise it pi above 7. The continual hyperacidity may lead to peptic or duodenal ulcer.

Describe in detail the method of preparation, Properties and uses of Ammonium chloride?

Ans. AMMONIUM CHLORIDE

Molecular Weight: 53.9

Molecular formula: NH_4Cl

Ammonium chloride contains not less than 99.5% of NH_4Cl, calculated with reference to substance dried over silica gel for 4 hours.

Preparation:

1) It is prepared by purifying the crude product by sublimation or by boiling ammonium sulphate solution with sodium chloride in the equivalent proportions.

2) Neutrlaization of HCl acid with ammonia and evaporation of solution to dryness yield ammonium chloride.

Properties: It is white, fine or coarse crystalline powder.

- It is having a cooling saline taste.
- It is odourless.
- It is sligthly hygroscopic.
- It is soluble in 2.6 parts of H_2O, 1.4 parts of boiling water & 100 parts of alcohol.

Assay: Weigh accurately about 0.2g sample

dissolve in 40ml of H_2O

add 3 ml of Nitric acid, 5 ml of Nitrobenzene & 50 ml of 0.1N Silver nitrate, shake vigorously for 1 minute

titrate with 0.1N ammoniunm thiocyanate using 2ml of solution of ferric ammonium sulphate as indicator.

Each ml of 0.1N silver nitrate is equivalent to 0.005349g of NH_4Cl.

Uses: It is used as an expectorant.

- It is used as a diuretic &e systemic acidifying agent.
- It is used to maintain the urine at acid pH in the treatment of some UTI disorders.

Explain in detail about Antacids with ideal properties & classification?

Ans. Antacids are the substance which are used to neutralise the gastric acidity. Acidity occurs due to excessive secretion of HCl in stomach due to various reasons. They produce sympathomimetic relief from pain, heart burns or by neutralizing the excess of hydrochloric acid. Peptic ulcers occur due to defective oesophageal sphincter as hiatal hernia. Gastric ulcers occur in lesser curvature and are found in first portion of duodenum.

The neutralizing capacity of an antacid is expressed in milliequivalents (mEq) of hydrochloric acid. Every antacid may have a total neutralizing capacity of atleast 5 mEq of HCl per dosage unit.

Antacids raise the pH of the gastric contents to above 3.5.

Antacids may be classified as

1. Systemic (absorable) antacids: These are soluble, readily absorable and capable of producing systemic electrolytic alterations and alkalosis. Example: Sodium Bicarboante.
2. Non-systemic (Non-absorable) antacids: These are not absorbed to a significant extent and thus do not exert an appreciable systemic effects e.g. Aluminium salts, Magnesium salts and Calcium Carbonate.

Ideal Characteristics of Antacids:

1. The antacid should not be absorbable or cause systemic alkalosis.
2. The antacid should not be a laxative or cause constipation.

3. The antacid should exert its effect rapidly and over a long period of time.
4. The antacid should have buffer in the pH range of 4-6.

5. The reaction of the antacid with gastric hydrochloric acid should not cause a large evolution of the acid
6. The antacid should Probably inhibit Pepsin.

Describe in detail the method of preparation, Properties and uses of Sodium bicarbonate?

Ans. SODIUM BICARBONATE

Molecular Weight: 84.01

Molecular formula: $NaHCO_3$

Synonyms: Sodium Hydrogen Carbonate, Baking Soda, Mitha Soda.

It is highly water soluble antacid with a very rapid onset of action but relatively short duration.

Preparations: On small scale, it is prepared by passing CO_2 gas through a solution of sodium hydroxide.

$$2NaOH + CO_2 \longrightarrow Na_2CO_3 + H_2O$$

$$Na_2CO, + H_2O + CO_2 \longrightarrow 2NaHCO_3$$

2. Solvay Process (Ammonia Soda Process): Strong solution of Sodium Chloride containing a high concentration of ammonia is passed through a carbonating tower where it is saturated with CO_2 gas under pressure.

$$NH_3 + CO_2 + H_2O \longrightarrow NH_4HCO_3$$

$$NH_4HCO_3 + NaCl \longrightarrow NaHCO_3 + NH_4Cl$$

Ammonia and Carbon Dioxide react to form Ammonium Bicarbonate which further undergo decomposition to form Sodium Bicarbonate.

It is specific in the treatment of systemic acidosis.

Properties: It ocurs as white crystalline or amorphous powder.

- It is having a saline taste.
- Its solution is alkaline in nature.
- It is freely soluble with water but practically insoluble in alcohol.

Assay:

Weigh accurately about 0.6gm of sodium carbonate, previously dried

↓

Dissolved in 50ml of water

↓

Titrate with 0.5ml HCl using bromophenol blue as indicator.

Uses: It is mainly used as electrolyte Replenisher.

- It is mainly used for its Acid Neutralizing properties.
- It is also find used as an antacid.
- It is used as local applicant for burns, insect bites etc.

Describe in detail the method of preparation, Properties and uses of Aluminium Hydroxide?

Ans. ALUMINIUM HYDROXIDE GEL

Chemical formula: $Al(OH)_3$

Molecular Weight: 77.99

Synonym: Aluminium Hydroxide Powder, Aluminium Hydrated Powder

It can be recognized into two ways

(a) Aluminium Hydroxide Gel

(b) Dried Aluminium Hydroxide Gel

(a) Aluminium Hydroxide Gel: It is white viscous suspension of Hydrated Aluminium Oxide with varying amount of basic Aluminium Carbonate. It gets separated into the clear 1iquid on standing for sometime. It exhibits suitable flavouring and antimicrobial agent. It has a pH between 5.5 and 8.0

Preparation: When an Aluminium Salt such as Aluminium Chloride is treated with Ammonia or Sodium Carbonate, a white gelatinous precipitate of aluminium hydroxide is obtained.

$AICl_3 + 3NH_4OH \rightarrow Al(OH)_3 + 3NH_4Cl$

$Al(OH)_3 + 3NaOH \rightarrow Na_3AlO_3 + 3H_2O$

After complete removal of CO_2 the precipitate Aluminium Hydroxide is filtered, washed throughly with hot water untill it become free from sulphates ions. The precipitate may be suspended in the purified water to strengthen aluminium hydroxide gel.

b) Dried Aluminium Hydroxide Gel

Synonyms: Aluminium Hydroxide powder.

Properties: It is not a typical gel but is a white, odorless, tasteless, amorphous powder.

- It is insoluble in water and alcohol but soluble in dilute mineral acids & solution of fixed Alkali Hydroxides.
- It forms gel on prolonged contact with water.
- It absorbs certain acids and CO_2.
- It has a pH between 5.5-8.0.

One major drawback of gel is that of a loss of antacid properties on aging

Storage:

It should not be stored at a temperature not exceeding 25˚C and should be stored in air tight containers.

Explain in detail about Saline cathartics with classification?

Ans. Cathartics may be defined as those drugs which are used to bring about defecation i.e. emptying of the stomach.

Cathartics are used to:

- To relieve from acute constipation.
- To ease in defecation of patients suffering from harmful haemorrhoids or other rectal disorders.
- To clear bowels from stomach before surgery.

Laxatives are mild Cathartics while Purgatives are used for strong Cathartics. They act both by retaining fluids in bowel. They should not be used on regular basis because they can cause water

and electrolyte imbalance.

Stimulants, Bulk forming, Emollients and Saline cathartics are the four types of laxatives.

They may be administrated either by oral route or by rectal route.

Inorganic compounds such as Sodium Potassium tartrate and Magnesium Sulphate widely used as Saline cathartics.

Classification: Laxatives can be conveniently classified into five classes:

1. Stimulant Laxatives: These act on the intestinal tract to increase its motor activity e.g. phenolphthalein, castor oil.

2. Saline Laxative: A number of magnesium salt as well as sulphate, phosphate and tartartes are used as saline cathartics/laxatives. These cations and anions are not absorbed or slightly absorbed from the gastro intestinal tract.

3. Bulk forming laxatives: These include natural and semisynthetic polysaccharides and cellular derivatives that are are only partially digested. The undigested portion is hydrophilic & swells in presence of water or viscous gel.

4. Lubricant laxativs: These drugs lubricates the intestinal tract, soften the faecal contents and lubricate the passage of feces.

5. Pecal softeners: Substance in this category are wetting agents e.g docusate sodium which are non-absorbable & relatively non-toxic.

Mode of action: The saline cathartics are act by increasing the osmotic load of GIT. These cathartics are salts of poorly soluble anions and cations. The body relieves hypertonicity of the gut by secreting additional fluid into the intestinal tract. This result in increased bulk in GIT. The resulting increasing bulk stimulates peristalsis. The saline cathartics are water soluble and are taken with large amounts of water.

Describe in detail the method of preparation, Properties and uses of Magnesium sulphate?

Ans. MAGNESIUM SULPHATE

Molecular Formula: $MgSO_47H_2O$

Molecular Weight: 246.5

Synonyms: Epsom salt, Magnesium sulphate

Method of Preparation: It is obtained by the action of dilute Sulphuric Acid on Magnesium Carbonate or Magnesium Oxide. The solution obtained is filtered off and then evaporated to crystallisation.

$$MgCO_3 + H_2SO_4 \longrightarrow MgSO_4 + H_2O + CO_2$$

$$MgO + H_2SO_4 \longrightarrow MgSO_4 + H_2O$$

Properties: It occurs as odourless, brilliant, colourless crystals or white crystalline powder.

- It is having a bitter saline and cooling taste.
- It efflorescence in warm dry air.
- It is soluble in water and sparingly soluble in alcohol.

Storage: It should be stored in a well closed container because of its efforvescent nature

Uses: It acts as a saline laxative.

- It is also used in the treatment of magnesium deficiency, hypertension and boils.

Describe in detail the method of preparation, Properties and uses of Sodium orthophosphate?

Ans. SODIUM ORTHOPHOSPHATE

Molecular weight: 358.14

Molecular formula: $Na_2HPO_4.12H_20$

Synonymns: Phosphor soda

Method of Preparation: It is prepared by reaction of Orthophosphoric Acid with Sodium Hydroxide.

$2NaOH + H_3PO_4 \quad Na_2HPO_4 + 2H_2O$

- From bone ashes or mineral phosphorite, which is then treated with Sulphuric Acid.

Properties: It is colourless, odorless, and crystalline powder.

- It is efflorescent.
- It is soluble in water and practically insoluble in alcohol.

Uses: It is used as a Pharmaceutical Aid and as a Saline Carthatic.

- It is used as a Buffering Agent.

Explain in detail about Antimicrobial agents with classification and mechanism?

Ans. An antimicrobial (disinfectant and antiseptic) is a substance that kills or inhibits the growth of microorganisms such as bacteria, fungi or protozoans. Antimicrobial drugs either kill microbes (microbiocidal) or prevent the growth of microbes (microbiostatic). Specific terminology describes exact mode or mechanism of action.

1. Antiseptics: Antiseptic is a substance that prevents or arrests the growth of a microorganisms. It acts by inhibiting their activity or destroying them especially of agents applied to living tissue like surface of skin, application of antiseptic dressing on wounds. The drugs like phenol, iodine, boric acid, cetrimide are the example of antiseptics.

2. Disinfectants: These are the drugs or substances used either to kill bacteria or prevent their growth or multiplication. It is used on non living objects or outside the body. For example: Disinfection of surgical instruments, sputum and urine containers on floor. Commonly used as disinfectants includes cresol, phenol.

3. Germicides: These are the substances which kill microorganisms. They act by oxidation of bacterial protoplasm, by denaturation or bacterlal enzymes and protein by increasing permeability of bacterial cell membrane. Potency of germicide is expressed by Phenol Coefficient. Specific terminology like bacteriocide (against bacteria), fungicide (against fungi), virucide (against Virus) etc. denotes exact action.

4. Bacteriostatics: These are the substances which primarily function by inhibiting the growth of bacteria. Thus, bacteriostatic drugs or agents do not kill but arrest growth of bacteria.

5. Sanitizers: Sanitizer is the process of rendering sanitary by reducing the number of bacterial contaminants. These are used to maintain general public health standard. Santization can be achieved only with surfaces and articles that are physically clean in addition to possess low bacterial counts or that are free from most vegetative microbes. High conc. of sanitizers also cause local cellular damage.

Inorganic compounds generally exhibit antimicrobial action by involving either of the following three mechanisms:

i) Oxidation

ii) Halogenation

iii) Protein precipitation.

Describe in detail the method of preparation, Properties and uses of hydrogen peroxide?

Ans. HYDROGEN PEROXIDE

Chemical Formula: H_2O_2

Molecular Weight: 34.016

It is an aqueous solution of hydrogen peroxide. It is having not less than 6% w/w of H_2O_2 which corresponds to about 20 times its volume of available oxygen.
It was discovered by French chemist Thenard.

Methods of Preparation: In laboratory, it is prepared by Merck's process. It is prepared by adding calculated amounts of sodium peroxide to ice cold dilute (20%) solution of H_2SO_4.

$Na_2O_2 + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O_2$

- On commercial scale, H_2O_2 can be prepared by the electrolysis of 50% H_2SO_4 solution. In a cell, peroxy sulphuric acid is formed at the anode.

$2H_2SO_4 \longrightarrow H_2S_2O_8(aq.) + H_2$

Properties: Hydrogen peroxide is clear, colourless syrupy liquid.

- It is odourless or may have an odour resembling to that of ozone unstable liquid.
- It is a strong Oxidizing agent.
- It is soluble with water from which it can be extracted with solvent ether.
- It rapidly decomposes in contact with oxidizable organic matter and with metals.

Assay: The assay is done on the basis of the oxidation reduction reaction.

↓

Dilute 10ml of the sample in 250ml volumetric flask with distilled water
To 25ml of this solution add 10ml of 5N sulphuric acid

↓

Titrate against 0.1N potassium permanganate solution until a faint pink color appears.

Each 1ml of 1N permanganate = 0.01701g of H_2O_2

Storage: It is not stored in glass bottles since the alkali metal oxides present in glass catalyse its decomposition. It is stored in paraffin wax coated with glass, plastic or teflon bottles.

Uses: It acts as an antiseptic and a germicide and hence is used for cleaning cuts and wounds.

- It is used for bleaching delicate articles like wool, hair, feather, ivory etc.
- It is used as an aerating agents in production of spong rubber.
- It is used as an antichlor.
- It finds use in deodorants.
- It is also used for cleaning ears and removing the surgical dressing.
- It is an effective antidote for phosphorous and cyanide poisoning.

Describe in detail the method of preparation, Properties and uses of chlorinatedlime?

Ans. CHLORINATED LIME OR BLEACHING POWDER

Chemical Formula: $Ca(CIO)_2$

Molecular Weight: 136.98

Synonyms: Bleaching powder, chloride of lime.

Method of Preparation: It is prepared by the chlorination of slaked lime.

$$2Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 + CaCl_2 + 2H_2O$$

It is usually a mixture of calcium hypochlorite ($Ca(OCI)_2$) and calcium chloride with some slaked lime

Properties: It is dull white powder with characteristic odour.

- It is slightly soluble in water and in alcohol.
- On exposure to air, it becomes moist and gradually decomposes with the lose of chlorine.
- Its aqueous solution is strongly alkaline.
- It is able to oxidize many salts such manganous salts to permanganate. Carbon dioxide gets absorbed and chlorine is evolved.

Assay:

Accurately weigh sample and dissolve in water

Transferred into iodine flask and then treated with excess of potassium iodide acidified with 5ml of acetic acid

Shake for 2-3 minutes and set aside for 15 minutes

Titrate with 0.1N sodium thiosulphate solution using starch solution as indicator till the deep iodine colour changes to yellow colour.

Each ml of 0.1N sodium thiosulphate = 0.003545 g of available chlorine.

Uses: It is also used as an ingredient in bleaching powder, used for bleaching cotton and linen.

- It is also used in sugar industry for bleaching sugar-cane juice before its crystallization.
- It is used as a sanitizer in outdoor swimming pools in combination with a cyanuric acid stabilizer which reduces the loss of chlorine due to ultraviolet radiation.
- It has the bactericidal action.

Describe in detail the method of preparation, Properties and uses of iodine and its preparation?

Ans. IODINE

Chemical Formula: I_2

Molecular Weight: 253.8

Iodine is a dark violet non-metallic halogen element.

Method of Preparation: Iodine is manufactured by extracting kelp (sea weed's ash) with water. The solution is concentrated when the sulphate and chloride of sodium and potassium get crystallized out, leaving freely soluble sodium and potassium iodides in the mother liquor. Sulphuric acid is added to the mother liquor which then gets decanted off.

$$2NaI + 3H_2SO_4 + MnO_2 \longrightarrow MnO_4 + 2NaHSO_4 + 2H_2O$$

In the laboratory, it reacts by heating potassium iodide or sodium iodide with dilute sulphuric acid and manganese dioxide.

$2KI + 3H_2SO_4 + MnO_2 \rightarrow 2KHSO_4 + I_2 + MnSO_4 + 2H_2O$

Properties: It occurs as heavy, bluish-black or greyish violet brittle plates with a metallic lusture.

- It is very slightly soluble in alcohol, chloroform and slightly soluble in concentrated solutions of iodides, carbon disulphide, solvent ether, carbon tetrachloride, chloroform, give violet solutions.

Uses: It is used as an anti-hyperthyroid.

- It is used in the manufacture of dye stuffs and drugs.
- It is used as a reagent in analytical chemistry.
- It is used in the manufacture of compounds used in photography.

Prolonged use of iodine may produce metallic taste, increased salivation, burning pain. It can give rise to allergic reactions also.

POVIDONE-IODINE (PV-I)

It is a stable chemical complex of Polyvinyl Pyrrolidone (povidone, PVP) and Elemental Iodine. It contains 9.0% to 12.0% available iodine, calculated on a dry basis. It belongs to iodophors class of compounds.

Properties: It is having a slight characteristic odour.

- It is a yellowish brown amorphous powder.
- It is soluble in water and alcohol but practically insoluble in organic solvents. It is acidic litmus.

Uses: It has a broad spectrum antiseptic for topical application in the treatment and prevention of infection in wounds.

- It is used as a disinfectant.
- It is also used as gargles and mouthwashes for the treatment of infections in the oral cavity.

Describe in detail the method of preparation, Properties and uses of potassium permanganate?

Ans. POTASSIUM PERMANGANATE

Chemical Formula: $KMnO_4$

Molecular Weight: 158.03

It is an inorganic chemical compound having not less than 99.0% of $KMnO_4$ Formerly known as Permanganate of Potash or Candy's Crystals.

Method of Preparation: On large scale, it is prepared by mixing a solution of KOH with powdered manganese oxide and potassium chlorate in the presence of air or an oxidizing agent.

$2KOH + MnO_2 + KClO_3 \longrightarrow K_2MnO_4 + KCl + H_2O$

Potassium manganate so formed is extracted along with boiling water and a current of chlorine, CO_2 or ozonised air is passed into the liquid untill it gets converted to permanganate. The MnO_2 formed is removed.

$K_2MnO_4 + 3Cl_2 \longrightarrow 6KMnO_4 + 6KCl$

When carbon dioxide is passed through the chlorine solution, manganate gets converted into $KMnO_4$.

$3K_2MnO_4 + 2CO_2 \longrightarrow 2KMnO_4 + MnO_2 + 2K_2CO_3$

Properties: It occurs as odourless dark purple or almost black prismatic crystals or granular powder.

- It has a sweet and astringent taste.
- It decomposes with a risk of explosion, in contact with certain organic substances.
- It has a specific gravity of about 2.703.
- It is stable in air.
- It is soluble in water.

Uses: It finds use in the treatment of urethritis.

- It possesses Oxidizing properties and oxidizes proteins and other bioorganic substance.
- It has the capability to destroy the poison and prevents absorption.
- Its solutions are used to clean the ulcer or abscesses, as wet dressings and in baths in

eczematous condition.

- It finds use as an antidote in the case of poisoning by barbiturates, chloral hydrate and many alkaloids.

IMPORTANT TERMS

- Acidifying agents are the inorganic chemical substances that either produce or increase acid.
- **Gastric Acidifiers:** These are the drugs which are used to increase the acidity of the stomach in patients suffering from Achlorhydria or Hypochlorhydria.
- **Urinary Acidifiers:** These are the drugs which are used to remove acidic urine from the body or to maintain the pH of the urine. These acidifiers are widely used to cure some types of urinary tract infections.
- **Systemic acidifiers:** These are the drugs which are able to neutralise the alkaline body fluids, especially blood or to maintain the pH of all parts of the body. It is used to treat patients suffering from systemic alkalosis.
- **Acid:** These are used as pharmaceutical aids in the preparation of medicaments, laboratory quality control.
- Antacids are the substance which are used to neutralise the gastric acidity. Acidity occurs due to excessive secretion of HCl in stomach due to various reasons. They produce sympathomimetic relief from pain, heart burns or by neutralizing the excess of hydrochloric acid.
- Systemic (absorable) antacids: These are soluble, readily absorable and capable of

producing systemic electrolytic alterations and alkalosis. Example: Sodium Bicarboante.

- Non-systemic (Non-absorable) antacids: These are not absorbed to a significant extent and thus do not exert an appreciable systemic effects e.g. Aluminium salts, Magnesium salts and Calcium Carbonate.

- Cathartics are defined as those drugs which are used to bring about defecation i.e. emptying of the stomach.
- Carthatics are used:

  To relieve from constipation

  To clear bowels before surgery

  To ease in defecation of patients suffering from painful haemorrhoids or other rectal disordes.
- Laxatives are mild Cathartics while Purgatives are used as strong Carthatics,
- Laxative and Purgatives both act by retaining fluid in the bowel.
- Laxative and Purgative may be administrated either by oral route (suspension or by Powder) or by rectal route (enema or suppository).
- An antimicrobial (disinfectant and antiseptic) is a substance that kills or inhibits the growth of micro-organism such as bacteria, fungi or protozoans.
- Antiseptic is a substance that prevents or arrests the growth of action of micro-organism.
- Disinfectant are the drugs or substances used either to kill bacteria or prevent their growth or multiplication.
- Germicides are the substances which kill micro-organisms.
- Bacteriostatics are the substances which primarily function by inhibiting the growth of bacteria.
- Santitizer is the process of rendering sanitary by reducing the number of bacteria contaminants.
- The basic difference between the disinfectant and antiseptic is that antiseptic is applied on living tissue while disinfectant is applied on non living object.
- The Pharmaceutical use of Chlorinated Lime is, it is used as an ingredient in bleaching powder. It is also used in the sugar industry for bleaching sugarcane juice.
- Povidone- Iodine (PV-I) is a stable complex of polyvinyl/pyrrolidone (Povidone, PVP) and elemental iodine.