



Amar Shaheed Baba Ajit Singh Jujhar Singh Memorial  
**COLLEGE OF PHARMACY**  
(An Autonomous College)  
BELA (Ropar) Punjab



Program	:	B. Pharmacy
Semester	:	1 <sup>st</sup>
Subject /Course	:	Pharmaceutical Inorganic Chemistry/ B. Pharmacy
Subject/Course ID	:	Pharmaceutical Inorganic Chemistry/ BP104T
Module No.	:	04
Module Title	:	Miscellaneous Compounds
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Learning Outcome of Module-4

LO	Particular	Course outcome module
1.	To understand the concept of Expectorant, Emetic, Poison, antidote & Haematinics.	BP104.4
2.	To understand the method to preparation inorganic pharmaceutical compounds.	BP104.4

**Module Content Table**

No.	Topic
1.	Expectorant
2.	Emetics
3.	Antidote & Poison
4.	Haematinics
5.	Astringent

## INTRODUCTION

Cough, a protective reflex (both voluntary and involuntary) helps to expel irritant matter from the respiratory tract. When a person coughs there is a short intake of breath and the larynx closes momentarily. It is a vital part of the defense mechanism. It can be caused by infections, chemical irritants, asthma, lung tumor, breathing in dust particles. It is of two types:

- 1) **Productive Cough:** A productive cough produces a phlegm or mucus (sputum). The mucus may have drained down the back of throat from the nose or from the lungs. A productive cough should not be suppressed. It clears mucus from the lungs.
- 2) **Irritative or Non-productive cough:** A non-productive cough does not produce sputum. A dry, hacking cough may develop towards the end of a cold or after exposure to an irritant such as dust and smoke.

## EXPECTORANT

The latin word "Expectorate" means "to drive from the chest. Expectorants are drugs used to help in the removal i.e. expulsion of secretions or exudate from the trachea, bronchii or lungs. Hence, they are used in the treatment of cough. They act upon the respiratory tract in two ways:

- i) By decreasing the viscosity of the bronchial secretion and facilitating their elimination, local irritants are expelled and ineffectual coughing is required.
- ii) By increasing the amount of respiratory tract fluid, a demulcent action is exerted on dry mucosal lining & relieving the unproductive cough.

Inorganic saline expectorants are:- Ammonium salts (Ammonium Chloride), iodide (Potassium/Sodium iodide), citrates and Antimony Potassium Citrate.

## POTASSIUM IODIDE

**Chemical Formula:** KI

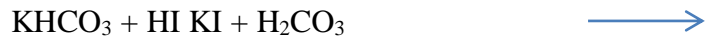
**Molecular Weight:** 166.01

**Synonyms:** Kalii iodidum, Pot. Iod.

**Method of Preparation:** It is prepared by treating iron filings with iodine under water to get iodide which is then reacted with potassium carbonate.



Hydroiodic acid when treated with potassium bicarbonate results in the formation of potassium iodide.



**Properties:** It occurs as odourless, transparent or opaque crystals.

- It is white granular powder.
- It is slightly hygroscopic, taste is saline and slightly bitter.
- It is very soluble in water and even more so in boiling water, freely soluble in glycerine and soluble in alcohol.
- On long exposure to air it becomes yellow due to liberation of iodine and small quantity of iodate may be formed.

**Uses:** It is used as an ingredient of expectorant mixture.

- It may be used for the prophylaxis and treatment of simple goiter.
- It is used as an antifungal agent in veterinary practice.
- Potassium iodide solution is used as iodine supplement.

### AMMONIUM CHLORIDE

**Chemical Formula:**  $NH_4Cl$

**Molecular Weight:** 53.49

**Synonyms:** Ammonium Muriate, Sal Ammoniac, Salmiac, Amchlor, Ammon. Chlor

Ammonium chloride occurs naturally in volcanic regions, forming on volcanic rocks near fume releasing vents.

**Method of preparation:** It is a product of the solvay process used to produce Ammonium Chloride and Sodium Carbonate.



This method is used to minimize ammonia release in some industrial operations.

Ammonium chloride is prepared by combining ammonia with either hydrogen chloride (gas) or hydrochloric acid.

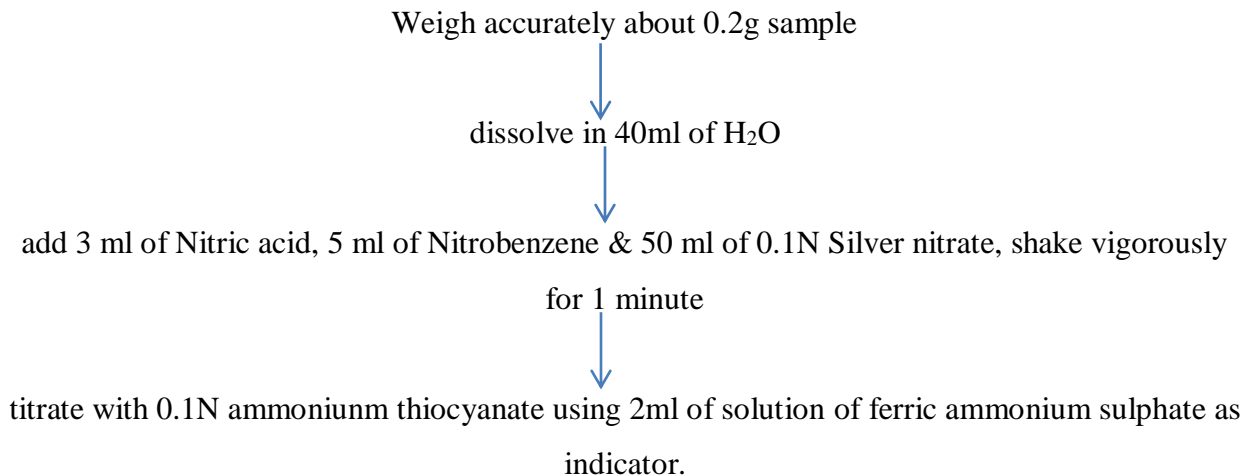


**Properties:** It is a white crystalline salt, highly soluble in water.

- Solutions of ammonium chloride are mildly acidic.
- It is somewhat hygroscopic.
- It is odourless and possesses cooling saline taste.
- On heating, it sublimes without melting

**Storage:** It should be stored in tightly closed containers because it is hygroscopic.

**Assay:**



Each ml of 0.1N silver nitrate is equivalent to 0.005349g of NH<sub>4</sub>Cl.

**Uses:** Ammonium chloride is a nitrogen source in fertilizers e.g. chloro ammonium phosphate.

- It is used as an expectorant in cough medicine. Its expectorant action is caused by irritative action on the bronchial mucosa.
- Ammonium chloride is used as a systemic acidifying agent in treatment of severe metabolic alkalosis.
- It is also used as a flavouring agent.
- It is used in the textile and leather industry in dyeing, tanning, textile printing and to luster cotton.
- It is used in hair shampoos as a thickening agent.

## EMETICS

An emetic is a drug that produces vomiting.

Vomiting is the involuntary, forceful expulsion of the content of one's stomach and sometimes the nose. Emetics act either directly or by stimulation of the chemoreceptor trigger zone in the

floor of 4<sup>th</sup> ventricle in medulla or reflexly by irritant action on gastro-intestinal tract. It is used medically where a substance has been ingested and must be expelled from the body immediately. Gastric secretions and likewise, vomiting are highly acidic. Salt water and mustard water have been used since ancient times as emetic. Hydrogen peroxide is used as an emetic in veterinary practise.

Inorganic compounds e.g. Copper sulphate, Sodium chloride, Zinc sulphate and Potassium antimony tartarate belong to the latter type. Emetics should be avoided in children and in the elderly pregnant women and in patients suffering from CNS depression, unconscious or in coma. If the vomiting reflex continues for an extended period, dehydration, hypokalaemia and alkalosis may occur and replacement of fluid and electrolytes may be necessary. Emetics are also sometimes used in the preparation of cough syrups.

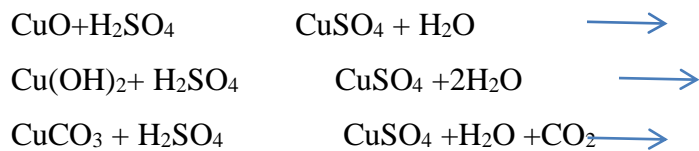
### **COPPER SULPHATE**

**Chemical Formula:**  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

**Molecular Weight:** 159.6

**Synonym:** Blue vitriol

**Preparation:** It is prepared by dissolving cupric oxide (or) cupric hydroxide (or) cupric carbonate in dilute sulphuric acid.



**Properties:** It is hydrated salt is blue in colour but anhydrous salt is colourless.

- It readily dissolves in water but is insoluble in alcohol.

**Assay:**

Weigh accurately 1g of copper sulphate in 50 ml of water

↓  
add 3 g of potassium iodide, 5ml of acetic acid

↓  
titrate the liberated iodine with 0.1 N Sodiumthiosulfate using solution of starch as indicator.

**Uses:** It is used as a germicide and insecticide in culture.

- It is used in electroplating, calico printing and in electrical batteries.

### **SODIUM POTASSIUM TARTARATE**

**Chemical Formula:**  $C_4H_4NaKO_4$

**Molecular Weight:** 210.158

**Synonyms:** Rochelle salt

**Properties:** It occurs as colourless Crystals,

- It is Saline in taste.
- It is soluble in hot water and insoluble in alcohol.

**Uses:** It is used as laxative.

- It has also been used in the process of silvering mirrors.

### **POISON**

Poison may be defined as any substance that when introduced into or absorbed by a living organism causes illness or death.

Poisoning occurs in many ways:

- by use of recreational substances (such as cannabis, opiates etc.)
- by intentional behavior
- by accidentally
- by occupational exposure

So, as to counteract the effects of a poison, antidotes are used.

### **ANTIDOTES**

An antidote is an agent with specific action against the activity or effect of a poison.

OR

An antidote is an agent which counteracts as a poison.

Whether accidental or intentional the poisoning requires only sympathomimetic and Supportive therapy i.e. removal of poison from the body is first priority in case of poisoning. It can be done by either gastric lavage or emesis induction (Gastric lavage is the process of cleaning the stomach) while (emesis induction can be done by the administration of substances like activated charcoal to reduce the absorption).

## CLASSIFICATION OF ANTIDOTES

The antidotes are classified into three types depending upon their mechanism of action.

**Physiological antidotes:** They act by producing the effects opposite to that of poison.

For example: Sodium nitrite which converts haemoglobin into methaemoglobin in order to bind cyanide, atropine & physostigmine.

**Mechanical antidotes:** These render the poison inert by mechanical action or prevent their absorption. For example: Activated charcoal absorbs the poison to absorption across the intestinal wall, mercuric chloride, sulphanilamide.

**Chemical antidotes:** They change the chemical nature of the poison.

For example: a) Sodium thiosulphate which changes toxic cyanide to non-toxic thiocyanate.

b) Sodium sulphate is used to precipitate lead.

c) Copper sulphate is used to precipitate phosphorous.

Universal antidote is a combination of physical and chemical antidote. It is an antidote which can be used in cases, where the nature of the poison swallowed is not definitely known. The universal antidote has following composition:

- 1) Powdered animal charcoal
- 2) Tannic acid
- 3) Magnesium oxide

## REASONS OF POISONING

Poisoning of the body is due to various reasons.

It can be due to the presence of heavy metals such as lead, arsenic, mercury, and cadmium; insecticides or pesticides used in our daily life and cyanide poisoning which occurs due to a variety of occupational sources.

## LEAD POISONING

Lead poisoning has been recognized as a major public health risk, particularly in developing countries. Though various occupational and public health measures have been undertaken in order to control lead exposure.

Lead is regarded as a potent occupational toxin and its toxicological manifestations are well known. In case of severe lead poisoning, Sodium calcium edetate & dimercapol are commonly used. Chelation therapy has so far been used.



Sodium Calcium Edetate leads from bone and the extra cellular space and then expels it out the urine. Dimercapol is more effective than the sodium calcium edetate as chelating. It lead from the soft tissues such as brain. Now a days, Succimer a water soluble analogue dimercapol has been increasingly preferred. It is suitably administrated by mouth and is well tolerated.

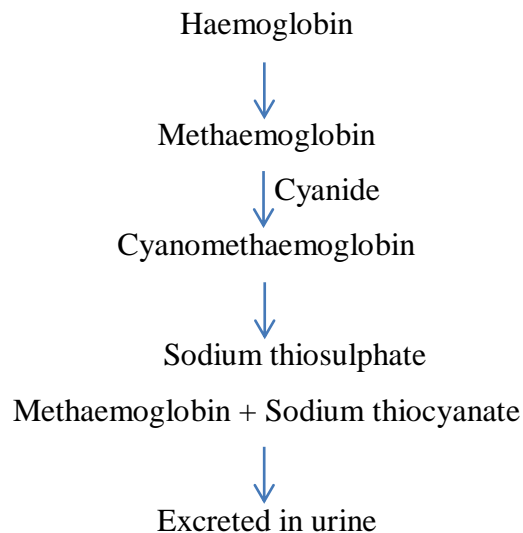
It occurs by a number or ways such as inhalation or ingestion of soluble cyanide salts or cyanide releasing substances like seeds of peach, apricot, cyanamide, cyanogen chloride and bitter almonds. It has a characteristic odour of bitter almonds.

The symptoms of cyanide poisoning are: Nausea, hypotension, dizziness, drowsiness, coma, convulsions and death.

## **CYANIDE POISONING**

Cyanide poisoning takes place intentionally or accidentally to commit suicide. Two inorganic antidotes are used such as sodium nitrite and sodium thiosulphate to counteract its poisoning.

Nitrate generates ferrous ion of haemoglobin to the ferric ion of methaemoglobin which has high affinity for cyanide radicals and form cyanomethaemoglobin. However, this may again dissociate to release cyanide. Therefore, sodium thiosulphate is given to form sodium thiocyanate which is poorly dissociable and is excreted in the urine.



Sodium nitrite is used for this purpose because it has a very weak vasodilator action.

## **SODIUM NITRITE**

**Chemical formula:**  $\text{NaNO}_2$

**Molecular weight:** 69.00

**Synonym:** Nitrous acid Sodium salt

**Preparation:** It can be prepared by strongly heating sodium nitrate



It is more conveniently made by heating the sodium nitrate with metallic lead or carbon which reduces it at lower temperature.



**Properties:** It is odourless, colourless to slightly yellow crystals.

- Its taste is saline.
- It is water soluble and sparingly soluble in alcohol.
- It is hygroscopic.
- It is slowly oxidized to nitrate in air.

**Uses:** It is used in treatment of cyanide poisoning in conjunction with sodium thiosulphate.

- Sodium nitrate is also used as a rust inhibitor preservative in foods such as cured meats for manufacturing dyes.
- It is used as a vasodilator.

### SODIUM THIOSULPHATE

**Chemical formula:**  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$

**Molecular Weight:** 248.2

**Synonym:** Sodium hyposulphate

**Preparation:** It can be prepared by boiling sodium sulphite with sulphur.



It can be obtained by mixing sulphide liquors sodium carbonate by passing  $\text{SO}_2$  gas.



It is prepared by passing the sulphur dioxide gas into solution of sodium carbonate.



The sodium bisulphate so obtained further reacts with sodium carbonate to give the sulphite.



**Properties:** It occurs in the form of large, colourless crystals.

- It is odourless and is having an alkaline taste.
- It efflorescens in warmy dry air above 33°C.
- It is soluble in water but insoluble in alcohol.
- When exposed to the moist air, it deliquesceslightly.

**Assay:**It is assayed by the iodometric titration.

Dissolve an accurately weighed amount of substance in water



titrate with 0.05M Iodine solution using starch mucilage as indicator.



End point is indicated by the presence of blue colour.

**Uses:**It is used in the treatment of Cyanide Poisoning.

- It is also used to treat parasitic skindiseases.
- It is used as antichlor in bleaching process in textile industry.
- It is widely used as stimulant analytical chemical.

## **ASTRINGENTS**

Topical astringents are used to firm up (tone) the skin.

A substance that controls or tightens tissue, thereby alleviating conditions such as diarrhoea, haemorrhages and secretion is known as astringent.

Astringent is applied to skin, mucous membrane and does not destruct the tissue. It will cause constriction of capillaries and small blood vessels. Astringent acts as protein precipitant and arrest discharge by causing shrinkage of tissue. Zinc Oxide and Calamine are astringents used in lotions, powders and ointments to relieve from itching and chopping in various forms of dermatitis. Astringent helps to reduce oiliness e.g. excessive precipitation.

Astringents have bacteriostatic properties, though they are not generally used as antiseptics. The protein-precipitation brought about by astringent is ascribed to presence of metallic ions having large charge/ radius ratio of strong electrostatic fields. The metal would form complex with various polar groups present on the protein or enzyme. This complexation of important functional group at active site of protein or an enzyme cause a drastic change in properties of the protein.

Astringent are used to treat diarrhoea, and also possess deodorant properties. Astringent promote healing Process.

## ALUM

Alum is both a specific and a class of chemical compound. The specific compound is Hydrated Potassium Aluminium Sulfate (potassium alum) with the formula  $KAl(SO_4)_2 \cdot 12H_2O$ . More widely, alums are double sulphate salts, with the formula  $AM(SO_4)_2 \cdot 12H_2O$  where A is a monovalent cation such as Potassium or Ammonium and M is a trivalent metal ion such as Aluminium or Chromium (III).

Alums are prepared by adding a hot, concentrated solution of either Potassium or Ammonium Sulphate to a hot solution of an equimolar proportion of Aluminium Sulphate and the alums get separate out.



**Properties:** Alum occurs as colourless, transparent, colourless crystals, white granules or powder.

- It has sweetish strongly astringent taste.
- Its crystals are sometimes opaque on the surface due to formation of traces of basic salt.
- It is freely soluble in water but slowly dissolves in glycerine and insoluble in alcohol.
- The aqueous solution is acidic to litmus.
- It is soluble in the water but insoluble in alcohol.

**Uses:** Alum is used as an ingredient of some brands of toothpaste or powders.

- It is used in many subunits vaccines as a adjuvant to enhance the body's response to immunogen.
- Vaccines include hepatitis A, hepatitis B and DTAP.
- It is used by pet owners to stem bleeding associated with animal injuries caused by improper nail clipping.
- It is used as a haemostatic agent, as mouth washes or gargles, as bladder irrigations.
- It is a powerful astringent.

- It is used in making lotions and douches. It has also been used as vaginal cleaning and deodorant preparations.

## ZINC SULPHATE

**Chemical Formula:**  $ZnSO_4 \cdot 7H_2O$

**Molecular Weight:** 287.54

**Synonym:** White Vitriol

**Preparation:** It is prepared by boiling metallic Zinc with dilute Sulphuric Acid. A slight excess of zinc metal is used and the reaction is allowed to continue until hydrogen gas evolves out.



The solution is filtered to separate unreacted Zinc, concentrated and crystallized.

- It may also be prepared by the action of dilute Sulphuric acid on Zinc Oxide



**Properties:** It occurs as colourless, transparent crystals or crystalline powder.

- It is odourless.
- Its taste is astringent and metallic.
- It is very soluble in water and freely soluble in glycerin.
- It effloresces in dry air.

**Storage:** Since it is efflorescent, it should be stored in tightly closed non-metallic containers.

**Uses:** It is widely used as an astringent and in emetic (induces vomiting).

- A 0.25% aqueous solution is also used as an ophthalmic astringent.
- It is used as reflex emetic especially in Narcotic poisoning (opium alkaloids poisoning).
- It has also been used internally as an emetic.

## HAEMATINICS

Haematinics are substances required in the formation of blood in process of hematopoiesis and are used for treatment of anaemias. The main haematinics are B12 & folate. These drugs increase the number of red blood cells and the amount of hemoglobin to normal level and above when they are below normal.

Anaemia occurs when the balance between production and reduction of red blood cells is disturbed

- Due to blood loss
- Impaired red cell formation due to  
Deficiency of essential factors: Iron, folic acid vitamin B12  
Bone marrow depression, erythropoietin deficiency
- Increased destruction of RBCs (Haemolyticaemia)

## FERROUS SULPHATE

**Molecular Formula:**  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$

**Molecular weight:** 278

**Synonyms:** Green vitriol

It contains not less than 98% and not more than 105% of  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ .

**Preparation:** When iron is treated with dilute  $\text{H}_2\text{SO}_4$  iron dissolve and form ferrous sulphate and hydrogen gas is liberated.



Ferrous sulphate is obtained commercially by exposing the moist iron pyrites to air when slow oxidation takes place.



**Properties:** It occurs as transparent, pale bluish green crystalline powder.

- It is odourless, metallic in taste.
- It is very soluble in boiling water, freely soluble in water but practically insoluble in alcohol.

**Assay:** Ferrous sulphate solution may bring about discolouration of the teeth in contact. The assay is based on oxidation reduction (redox) titration.

An acidified solution of substance is titrated with ceric ammonium sulphate in presence of sulphuric acid using ferrous sulphate solution as an indicator.

Weigh accurately 1gm of ferrous sulphate  
↓  
dissolve in 20ml of dilute sulphuric acid in 30ml of water  
↓

Titrate the contents of flask with potassium Permanganate until a permanent pink colour is obtained.

**Uses:** It is used as hematinic in the treatment of iron deficiency anaemia.

- It is used to dye fabrics and in tanning leather.

### **FERROUS GLUCONATE**

**Molecular formula:**  $C_{12}H_{22}FeO_{14} \cdot 2H_2O$

**Molecular weight:** 482.2

**Preparation:** It is obtained by dissolving ferrous carbonate in calculated amount of gluconic acid. First of all gluconic acid is prepared by the oxidation of glucose.



Gluconic acid is treated with  $BaCl_2$  solution which is then treated with  $FeSO_4$  solution.  $BaSO_4$  precipitates out & is removed by filtration.

**Properties:** It occurs as a fine, yellowish gray & pale greenish yellow powder or granules with slight burnt sugar.

- It is freely but slowly soluble in water.

**Use:** It is used for the preparation of ferrous Gluconate tablets.

**MULTIPLE CHOICE QUESTIONS**

**1. Productive cough produces?**

a) Mucus



b) Vomiting

c) Amalgam

d) None of these

**2. Which cough does not produce mucus?**

a) Productive cough

b) Both a) and c)

**c) Non-productive cough**

d) None of these

**3. Which inorganic compound is used as Emetic?**

a) Ammonium chloride

**b) Potassium antimony tartarate**

c) Potassium iodide

d) Potassium citrate

**4. 'KI' stands for**

**a) Potassium iodide**

b) Potassium iodate

c) Potassium citrate

d) None of these

**5. Emetics act?**

**a) By stimulation of the chemoreceptor trigger zone**

b) By increasing the amount of fluid

c) By decreasing the viscosity of the bronchial secretion

d) None of these

**6. If the vomiting reflex continues for an extended period, occurs?**

a) Dehydration

b) Alkalosis

c) Hypokalemia

**d) All of the above**

**7. An important antidote in the treatment of cyanide poison is?**

a) Ethanol

- b) Atropine
- c) Desferioxamine

**d) Sodium thiosulphate**

**8. In case of poisoning, activated charcoal acts to reduce absorption of the substance by?**

- a) Increasing osmotic pressure of the intestinal contents
- b) Shortening transit time through the gut

**c) Binding to the poison molecules**

- d) Stimulating the chemoreceptor trigger zone in the medulla

**9. When a poison is inhaled what methods you will be thinking of to manage the case?**

- a) Induction of emesis
- b) Thinking of an active elimination technique

**c) Administration of an antidote**

**d) Both b) and c)**

**10. An antidote is used?**

**a) To counteract the poison**

- b) To enhance the poison
- c) To cause illness e.g. death
- d) To produce consciousness

**11. Which of the following antidotes is not used in cyanide poisoning?**

- a) Sodium thiosulphate
- b) **Sodium nitrite**
- c) Dimercapol
- d) Sodium calcium EDTA

**12. Which kind of antidote reduces the poison across the intestinal wall?**

**a) Mechanical antidote**

- b) Physiological antidote
- c) Chemical antidote
- d) None of the above

**13. Physiological antidotes act by?**

- a) Absorption of the poison

- b) Changing the chemical nature of the poison
- c) Producing the effects opposite to that of poison**
- d) By countering the effects of poison

**14. "Cyanide poisoning kit" contains following?**

- a) Sodium nitrite
- b) Amyl nitrite
- c) Sodium bicarbonate**
- d) Sodium thiosulphate

**15. How does mechanical antidote act?**

- a) By producing the effects opposite to that of poison
- b) By preventing the absorption of poison into the body**
- c) By changing the chemical nature of the poison
- d) By changing the physical nature of the poison

**16. Which one of the following is an example of Physiological Antidote?**

- a) Sodium nitrite**
- b) Sodium thiocyanate
- c) Activated charcoal
- d) Copper sulphate

**17. Cyanide Poisoning has a characteristic odour of?**

- a) Bitter almonds**
- b) Wheat
- c) Lemon
- d) Caraway

**18. Sodium nitrite is given in conjunction with?**

- a) Sodium bicarbonate
- b) Sodium thiosulphate**
- c) Sodium calcium edetate
- d) Dimercaprol

**19. What is the effect of astringents on tissues?**

- a) Contraction

- b) Shrinkage
- c) **Both a & b**
- d) None of these

**20. How do astringents act?**

- a) Lipid precipitant
- b) Bacterial inhibition
- c) **Protein precipitant**
- d) Enzymatic catalysis

**21. Zinc sulphate is also known as?**

- a) **White vitriol**
- b) Red vitriol
- c) Blue vitriol
- d) Yellow vitriol

**22. Which inorganic astringent is used in the treatment of necrotic poisoning?**

- a) Alum
- b) **Zinc Sulphate**
- c) Aluminium chloride
- d) Zirconium Sulphate

### **LONG ANSWER QUESTIONS**

**Q.1. Define cough & Expectrorant?**

**Ans:**Cough, a protective reflex (both voluntary and involuntary) helps to expel irritant matter from the respiratory tract. When a person coughs there is a short intake of breath and the larynx closes momentarily. It is a vital part of the defense mechanism. It can be caused by infections, chemical irritants, asthma, lung tumor, breathing in dust particles. It is of two types:

1) **Productive Cough:**A productive cough produces a phlegm or mucus (sputum). The mucus may have drained down the back of throat from the nose or from the lungs. A protective cough should not be suppressed. It clears mucus from the lungs.

2) **Irritative or Non-productive cough:** A non-productive cough does not produce sputum. A dry, hacking cough may develop towards the end of a cold or after exposure to an irritant such as dust and smoke.

### EXPECTORANT

The latin word "Expectorate" means "to drive from the chest. Expectorants are drugs used to help in the removal i.e. expulsion of secretions or exudate from the trachea, bronchii or lungs. Hence, they are used in the treatment of cough. They act upon the respiratory tract in two ways:

- i) By decreasing the viscosity of the bronchial secretion and facilitating their elimination, local irritants are expelled and ineffectual coughing is required.
- ii) By increasing the amount of respiratory tract fluid, a demulcent action is exerted on dry mucosal lining & relieving the unproductive cough.

Inorganic saline expectorants are:- Ammonium salts (Ammonium Chloride), iodide (Potassium/Sodium iodide), citrates and Antimony Potassium Citrate.

**Q.2. Give the method of preparation, properties and uses of Potassium iodide?**

**Ans: POTASSIUM IODIDE**

**Chemical Formula:** KI

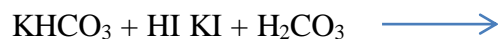
**Molecular Weight:** 166.01

**Synonyms:** Kalii iodidum, Pot. Iod.

**Method of Preparation:** It is prepared by treating iron filling with iodine under water to get iodide which is then reacted with potassium carbonate.



Hydroiodic acid when treated with potassium bicarbonate results in the formation of potassium iodide.



**Properties:** It occurs as odourless, transparent or opaque crystals.

- It is white granular powder.
- It is slightly hygroscopic, taste is saline and slightly bitter.
- It is very soluble in water and even more so in boiling water, freely soluble in glycerine and soluble in alcohol.
- On long exposure to air it becomes yellow due to liberation of iodine and small quantity of iodate may be formed.

**Uses:** It is used as an ingredient of expectorant mixture.

- It may be used for the prophylaxis and treatment of simple goiter.
- It is used as an antifungal agent in veterinary practice.
- Potassium iodide solution is used as iodine supplement.

**Q.3. Give the method of preparation, properties and uses of Ammonium chloride?**

**Ans:** AMMONIUM CHLORIDE

**Chemical Formula:** NH<sub>4</sub>Cl

**Molecular Weight:** 53.49

**Synonyms:** Ammonium Muriate, Sal Ammoniac, Salmiac, Amchlor, Ammon. Chlor

Ammonium chloride occurs naturally in volcanic regions, forming on volcanic rocks near fume releasing vents.

**Method of preparation:** It is a product of the Solvay process used to produce Ammonium Chloride and Sodium Carbonate.



This method is used to minimize ammonia release in some industrial operations.

Ammonium chloride is prepared by combining ammonia with either hydrogen chloride (gas) or hydrochloric acid.



**Properties:** It is a white crystalline salt, highly soluble in water.

- Solutions of ammonium chloride are mildly acidic.
- It is somewhat hygroscopic.
- It is odourless and possesses cooling saline taste.
- On heating, it sublimes without melting

**Storage:** It should be stored in tightly closed containers because it is hygroscopic.

**Assay:**

Weigh accurately about 0.2g sample

↓

dissolve in 40ml of H<sub>2</sub>O

↓

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 ammonium 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<sub>4</sub>Cl.

**Uses:** Ammonium chloride is a nitrogen source in fertilizers e.g. chloro ammonium phosphate.

- It is used as an expectorant in cough medicine. Its expectorant action is caused by irritative action on the bronchial mucosa.
- Ammonium chloride is used as a systemic acidifying agent in treatment of severe metabolic alkalosis.
- It is also used as a flavouring agent.

- It is used in the textile and leather industry in dyeing, tanning, textile printing and to luster cotton.
- It is used in hair shampoos as a thickening agent.

**Q.4. Define Emetics also explain Sodium potassium tartarate?**

**Ans:** An emetic is a drug that produces vomiting.

Vomiting is the involuntary, forceful expulsion of the content of one's stomach and sometimes the nose. Emetics act either directly or by stimulation of the chemoreceptor trigger zone in the floor of 4<sup>th</sup> ventricle in medulla or reflexly by irritant action on gastro-intestinal tract. It is used medically where a substance has been ingested and must be expelled from the body immediately. Gastric secretions and likewise, vomiting are highly acidic. Salt water and mustard water have been used since ancient times as emetic. Hydrogen peroxide is used as an emetic in veterinary practise.

Inorganic compounds e.g. Copper sulphate, Sodium chloride, Zinc sulphate and Potassium antimony tartarate belong to the latter type. Emetics should be avoided in children and in the elderly pregnant women and in patients suffering from CNS depression, unconscious or in coma.

If the vomiting reflex continues for an extended period, dehydration, hypokalaemia and alkalosis may occur and replacement of fluid and electrolytes may be necessary. Emetics are also sometimes used in the preparation of cough syrups.

**SODIUM POTASSIUM TARTARATE**

**Chemical Formula:**  $C_4H_4NaKO_4$

**Molecular Weight:** 210.158

**Synonyms:** Rochelle salt

**Properties:** It occurs as colourless Crystals,

- It is Saline in taste.



- It is soluble in hot water and insoluble in alcohol.

**Uses:** It is used as laxative.

- It has also been used in the process of silvering mirrors.

**Q.5. Give the method of preparation, properties and uses of Copper sulphate?**

**Ans:** COPPER SULPHATE

**Chemical Formula:**  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

**Molecular Weight:** 159.6

**Synonym:** Blue vitriol

**Preparation:** It is prepared by dissolving cupric oxide (or) cupric hydroxide (or) cupric carbonate in dilute sulphuric acid.



**Properties:** It is hydrated salt is blue in colour but anhydrous salt is colourless.

- It readily dissolves in water but is insoluble in alcohol.

**Assay:**

Weigh accurately 1 g of copper sulphate in 50 ml of water



add 3 g of potassium iodide, 5ml of acetic acid



titrate the liberated iodine with 0.1 N Sodiumthiosulfate using solution of starch as indicator.

**Uses:** It is used as a germicide and insecticide in culture.

- It is used in electroplating, calico printing and in electrical batteries.

**Q.6. Define poison & Antidote also explain classification of antidote?**

**Ans:POISON**

Poison may be defined as any substance that when introduced into or absorbed by a living organism causes illness or death.

Poisoning occurs in many ways:

- by use of recreational substances (such as cannabis, opiates etc.)
- by intentional behavior
- by accidentally
- by occupational exposure

So, as to counteract the effects of a poison, antidotes are used.

**ANTIDOTES**

An antidote is an agent with specific action against the activity or effect of a poison.

OR

An antidote is an agent which counteracts as a poison.

Whether accidental or intentional the poisoning requires only sympathomimetic and Supportive therapy i.e. removal of poison from the body is first priority in case of poisoning. It can be done by either gastric lavage or emesis induction (Gastric lavage is the process of cleaning the stomach) while (emesis induction can be done by the administration of substances like activated charcoal to reduce the absorption).

**CLASSIFICATION OF ANTIDOTES**

The antidotes are classified into three types depending upon their mechanism of action.

**Physiological antidotes:** They act by producing the effects opposite to that of poison.

For example: Sodium nitrite which converts haemoglobin into methaemoglobin in order to bind cyanide, atropine & physostigmine.

**Mechanical antidotes:** These render the poison inert by mechanical action or prevent their absorption.

For example: Activated charcoal absorbs the poison to absorption across the intestinal wall, mercuric chloride, sulphanilamide.

**Chemical antidotes:** They change the chemical nature of the poison.

For example: a) Sodium thiosulphate which changes toxic cyanide to non-toxic thiocyanate.

b) Sodium sulphate is used to precipitate lead.

c) Copper sulphate is used to precipitate phosphorous.

Universal antidote is a combination of physical and chemical antidote. It is an antidote which can be used in cases, where the nature of the poison swallowed is not definitely know. The universal antidote has following composition:

1) Powdered animal charcoal

2) Tannic acid

3) Magnesium oxide

## REASONS OF POISONING

Poisoning of the body is due to various reasons.

It can be due to the presence of heavy metals such as lead, arsenic, mercury, and cadmium; insecticides or pesticides used in our daily life and cyanide poisoning which occurs due to a variety of occupational sources.

### Q.7. Explain Lead & Cyanide poisoning?

**Ans: LEAD POISONING**

Lead poisoning has been recognized as a major public health risk, particularly in developing countries. Though various occupational and public health measures have been undertaken in order to control lead exposure.

Lead is regarded as a potent occupational toxin and its toxicological manifestations are well known. In case of severe lead poisoning, Sodium calcium edetate & dimercapol are commonly used. Chelation therapy has so far been used.

Sodium Calcium Edetate leads from bone and the extra cellular space and then expels it out the urine. Dimercapol is more effective than the sodium calcium edetate as chelating. It lead from the soft tissues such as brain. Now a days, Succimer a water soluble analogue dimercapol has been increasingly preferred. It is suitably administrated by mouth and is well tolerated.

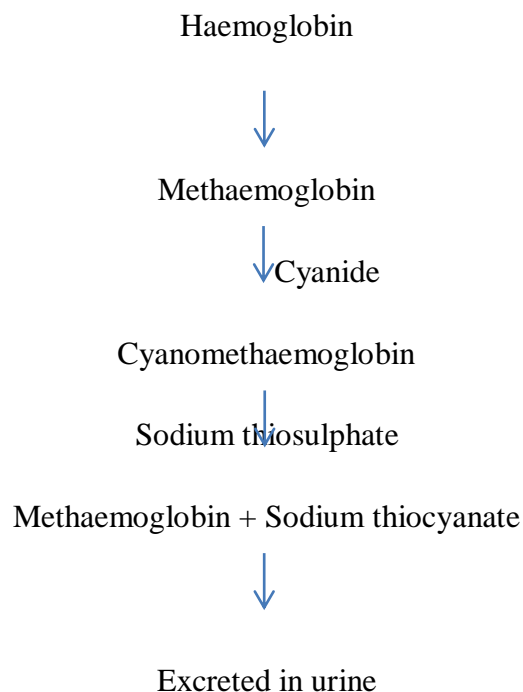
It occurs by a number of ways such as inhalation or ingestion of soluble cyanide salts or cyanide releasing substances like seeds of peach, apricot, cyanamide, cyanogen chloride and bitter almonds. It has a characteristic odour of bitter almonds.

The symptoms of cyanide poisoning are: Nausea, hypotension, dizziness, drowsiness, coma, convulsions and death.

## CYANIDE POISONING

Cyanide poisoning takes place intentionally or accidentally to commit suicide. Two inorganic antidotes are used such as sodium nitrite and sodium thiosulphate to counteract its poisoning.

Nitrite generates ferrous ion of haemoglobin to the ferric ion of methaemoglobin which has high affinity for cyanide radicals and form cyanomethaemoglobin. However, this may again dissociate to release cyanide. Therefore, sodium thiosulphate is given to form sodium thiocyanate which is poorly dissociable and is excreted in the urine.



Sodium nitrite is used for this purpose because it has a very weak vasodilator action.

**Q.8. Give the method of preparation, properties and uses of Sodium nitrite?**

**Ans: SODIUM NITRITE**

**Chemical formula:** NaNO<sub>2</sub>

**Molecular weight:** 69.00

**Synonym:** Nitrous acid Sodium salt

**Preparation:** It can be prepared by strongly heating sodium nitrate



It is more conveniently made by heating the sodium nitrate with metallic lead or carbon which reduces it at lower temperature.



**Properties:** It is odourless, colourless to slightly yellow crystals.

- Its taste is saline.
- It is water soluble and sparingly soluble in alcohol.
- It is hygroscopic.
- It is slowly oxidizes to nitrate in air.

**Uses:** It is used in treatment of cyanide poisoning in conjunction with sodium thiosulphate.

- Sodium nitrate is also used as a rust inhibitor preservative in foods such as cured meats for manufacturing dyes.
- It is used as a vasodilator.

**Q.9. Give the method of preparation, properties and uses of Sodium thiosulphate?**

**Ans: SODIUM THIOSULPHATE**

**Chemical formula:** Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>·5H<sub>2</sub>O

**Molecular Weight:** 248.2

**Synonym:** Sodium hyposulphate

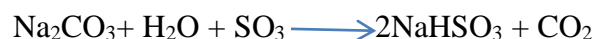
**Preparation:** It can be prepared by boiling sodium sulphite with sulphur.



It can be obtained by mixing sulphide liquors sodium carbonate by passing SO<sub>2</sub> gas.



It is prepared by passing the sulphur dioxide gas into solution of sodium carbonate.



The sodium bisulphate so obtained further reacts with sodium carbonate to give the sulphite.



**Properties:** It occurs in the form of large, colourless crystals.

- It is odourless and is having an alkaline taste.
- It efflorescens in warmy dry air above 33°C.
- It is soluble in water but insoluble in alcohol.
- When exposed to the moist air, it deliquesceslightly.

**Assay:** It is assayed by the iodometric titration.

Dissolve an accurately weighed amount of substance in water



titrate with 0.05M Iodine solution using starch mucilage as indicator.



End point is indicated by the presence of blue colour.

**Uses:** It is used in the treatment of Cyanide Poisoning.

- It is also used to treat parasitic skin diseases.
- It is used as antichlor in bleaching process in textile industry.
- It is widely used as stimulant analytical chemical.

**Q.10. Explain in about Astringents?**

**Ans:** Topical astringents are used to firm up (tone) the skin.

A substance that controls or tightens tissue, thereby alleviating conditions such as diarrhoea, haemorrhages and secretion is known as astringent.

Astringent is applied to skin, mucous membrane and does not destruct the tissue. It will cause constriction of capillaries and small blood vessels. Astringent acts as protein precipitant and arrest discharge by causing shrinkage of tissue. Zinc Oxide and Calamine are astringents used in lotions, powders and ointments to relieve from itching and chapping in various forms of dermatitis. Astringent helps to reduce oiliness e.g. excessive precipitation.

Astringents have bacteriostatic properties, though they are not generally used as antiseptics. The protein-precipitation brought about by astringent is ascribed to presence of metallic ions having large charge/ radius ratio of strong electrostatic fields. The metal would form complex with various polar groups present on the protein or enzyme. This complexation of important functional group at active site of protein or an enzyme cause a drastic change in properties of the protein.

Astringent are used to treat diarrhoea, and also possess deodorant properties. Astringent promote healing Process.

**Q.11. Give the method of preparation, properties and uses of Alum?**

**Ans:** **ALUM**

Alum is both a specific and a class of chemical compound. The specific compound is Hydrated Potassium Aluminium Sulfate (potassium alum) with the formula  $KAl(SO_4)_2 \cdot 12H_2O$ . More

widely, alums are double sulphate salts, with the formula  $AM(SO_4)_2 \cdot 12H_2O$  where is a monovalent cation such as Potassium or Ammonium and M is a trivalent metal ion such as Aluminium or Chromium (III).

Alums are prepared by adding a hot, concentrated solution of either Potassium or Ammonium Sulphate to a hot solution of an equimolar proportion of Aluminium Sulphate and the alums get separate out.



**Properties:** Alum occurs as colourless, transparent, colourless crystals, white granules or powder.

- It has sweetish strongly astringent taste.
- Its crystals are sometimes opaque on the surface due to formation of traces of basic salt.
- It is freely soluble in water but slowly dissolves in glycerine and insoluble in alcohol.
- The aqueous solution is acidic to litmus.
- It is soluble in the water but insoluble in alcohol.

**Uses:** Alum is used as an ingredient of some brands of toothpaste or powders.

- It is used in many subunits vaccines as a adjuvant to enhance the body's response to immunogen.
- Vaccines include hepatitis A, hepatitis B and DTAP.
- It is used by pet owners to stem bleeding associated with animal injuries caused by improper nail clipping.
- It is used as a haemostatic agent, as mouth washes or gargles, as bladder irrigations.
- It is a powerful astringent.
- It is used in making lotions and douches. It has also been used as vaginal cleaning and deodorant preparations.

**Q.12. Give the method of preparation, properties and uses of Zinc sulphate?**



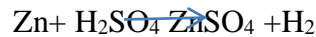
**Ans: ZINC SULPHATE**

**Chemical Formula:**  $ZnSO_4 \cdot 7H_2O$

**Molecular Weight:** 287.54

**Synonym:** White Vitriol

**Preparation:** It is prepared by boiling metallic Zinc with dilute Sulphuric Acid. A slight excess of zinc metal is used and the reaction is allowed to continue until hydrogen gas evolves out.



The solution is filtered to separate unreacted Zinc, concentrated and crystallized.

- It may also be prepared by the action of dilute Sulphuric acid on Zinc Oxide



**Properties:** It occurs as colourless, transparent crystals or crystalline powder.

- It is odourless.
- Its taste is astringent and metallic.
- It is very soluble in water and freely soluble in glycerin.
- It efflorescent in dry air.

**Storage:** Since it is efflorescent, it should be stored in tightly closed non-metallic containers.

**Uses:** It is widely used as an astringent and in emetic (induces vomiting).

- A 0.25% aqueous solution is also used as an ophthalmic astringent.
- It is used as reflex emetic especially in Narcotic poisoning (opium alkaloids poisoning).
- It has also been used internally as an emetic.

**Q.13. Define anaemia & haematinics?**

**Ans:** Anaemia occurs when the balance between production and reduction of red blood cells is disturbed

- Due to blood loss
- Impaired red cell formation due to  
Deficiency of essential factors: Iron, folic acid vitamin B12  
Bone marrow depression, erythropoietin deficiency
- Increased destruction of RBCs (Haemolytic anaemia)

Haematinics are substances required in the formation of blood in process of hematopoiesis and are used for treatment of anaemias. The main haematinics are B12 & folate. These drugs increase the number of red blood cells and the amount of hemoglobin to normal level and above when they are below normal.

**Q.14. Give the method of preparation, properties and uses of ferrous sulphate?**

**Ans:** FERROUS SULPHATE

**Molecular Formula:** FeSO<sub>4</sub>.7H<sub>2</sub>O

**Molecular weight:** 278

**Synonyms:** Green vitriol

It contains not less than 98% and not more than 105% of FeSO<sub>4</sub>.7H<sub>2</sub>O.

**Preparation:** When iron is treated with dilute H<sub>2</sub>SO<sub>4</sub> iron dissolves and forms ferrous sulphate and hydrogen gas is liberated.



Ferrous sulphate is obtained commercially by exposing the moist iron pyrites to air when slow oxidation takes place.



**Properties:** It occurs as transparent, pale bluish green crystalline powder.

- It is odourless, metallic in taste.
- It is very soluble in boiling water, freely soluble in water but practically insoluble in alcohol.

**Assay:** Ferrous sulphate solution may bring about discolouration of the teeth in contact. The assay is based on oxidation reduction (redox) titration.

An acidified solution of substance is titrated with ceric ammonium sulphate in presence of sulphuric acid using ferrous sulphate solution as an indicator.

Weigh accurately 1gm of ferrous sulphate



dissolve in 20ml of dilute sulphuric acid in 30ml of water



Titrate the contents of flask with potassium Permanganate until a permanent pink colour is obtained.

**Uses:** It is used as hematinic in the treatment of iron deficiency anaemia.

- It is used to dye fabrics and in tanning leather.

**Q.15. Explain in detail about chemical formula, properties and uses of ferrous gluconate?**

**Ans: FERROUS GLUCONATE**

**Molecular formula:**  $C_{12}H_{22}FeO_{14} \cdot 2H_2O$

**Molecular weight:** 482.2

**Preparation:** It is obtained by dissolving ferrous carbonate in calculated amount of gluconic acid. First of all gluconic acid is prepared by the oxidation of glucose.



Gluconic acid is treated with  $\text{BaCl}_2$  solution which is then treated with  $\text{FeSO}_4$  solution.  $\text{BaSO}_4$  precipitates out & is removed by filtration.

**Properties:** It occurs as a fine, yellowish gray & pale greenish yellow powder or granules with slight burnt sugar.

- It is freely but slowly soluble in water.

**Use:** It is used for the preparation of ferrous Gluconate tablets.

## IMPORTANT TERMS

- Cough, a protective reflex (both voluntary and involuntary) helps to expel irritant matter from the respiratory tract.
- Cough is of two types: Productive cough, Non-productive cough
- Productive cough produces a phlegm or mucus (sputum).
- Non-productive cough does not produce sputum.
- Expectorants are drugs used to help in the removal "expulsion" of secretions or exudate from the trachea, bronchi or lungs.
- Expectorants act upon the respiratory tract in two ways:
  - By decreasing the viscosity of the bronchial secretion and facilitating their elimination local irritants are expelled and ineffectual coughing is required.
  - By increasing the amount of respiratory tract fluid, a demulcent action is exerted on dry mucosal lining and relieving the unproductive cough.
- An emetic is a drug that produces vomiting.
- Vomiting is the involuntary; forceful expulsion of the content of one's stomach and sometimes the nose.
- Emetics act either directly or by stimulation of the chemoreceptor trigger zone in the floor of the 4th ventricle in the medulla or reflexly by irritant action on the gastrointestinal tract.
- Ammonium chloride is used as an expectorant in cough medicine and antacids.
- Poison is defined as any substance that when introduced into or absorbed by the body causes illness and death.

- An antidote is an agent which counteracts as a poison.
- Removal of the poison from the body can be done by Gastric lavage, Emesis Induction and Haemodialysis.
- Antidotes can be classified into three categories depending upon their mechanism of action
  - a) Physiological antidote
  - b) Mechanical antidote
  - c) Chemical antidote
- Astringent is a substance that causes the contraction or shrinkage of tissue, that dries up secretions.
- Astringent act as Protein precipitant.