

## Antioxidants :

Antioxidants are used in pharmaceutical preparations containing easily oxidized substances for maintaining these substances to their reduced form. They are chemically reducing agents.

Examples :- Hypophosphorous acid, Sulphur dioxide etc.

### \* Hypophosphorous acid :

Chemical formula :-  $\text{H}_3\text{PO}_2$ .

Mol. Weight :- 66.0

### Preparation :

It is conveniently prepared by treating  $\text{NaH}_2\text{PO}_2$  with an ion-exchange resin.

### Physical Character :

It is a colourless or slightly yellow odourless liquid.

### Chemical Character / Properties :

It is a monobasic and reducing agent. It contains 30 to 32 percent of  $\text{H}_3\text{PO}_2$ . It is decomposed by heat into  $\text{H}_3\text{PO}_4$  and spontaneously flammable  $\text{PH}_3$ . It is miscible with water, alcohol and ether.

### Test for purity :

Tests for barium; calcium; iron; chloride; sulphate; phosphoric acid; oxalic acid; oxalic acid; Weight per ml.

### Incompatibility :

Combination of hypophosphorous acid with oxidizing agents such as nitrates, chlorates or permanganates forms explosive mixtures in compound concentrated amounts.

### Assay :

The acid (10g) is diluted with water (50ml) and titrated with 0.5 N sodium hydroxide, using methyl orange solution as indicator. Each ml of 0.5 N sodium hydroxide is equivalent to 0.03300 g of  $H_3PO_2$ .

### Uses :-

Hypophosphorous acid is used as an antioxidant.

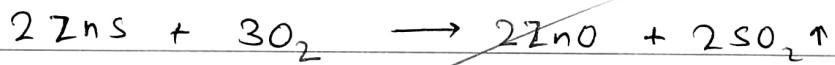
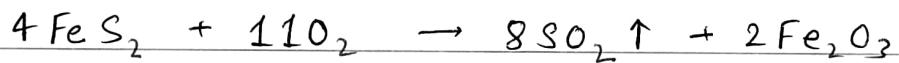
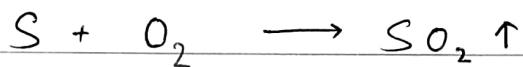
Salts of hypophosphorous acid, eg. sodium and ammonium hypophosphate, are present as a preservative in certain food and preparations.

## \* Sulphur Dioxide

Chemical formula :  $\text{SO}_2$   
 Mol. Weight : 64.06

### Preparation :

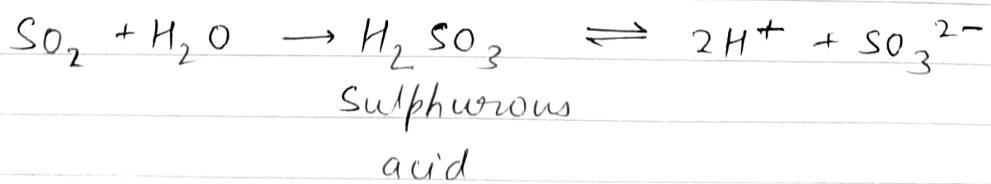
1. Sulphur dioxide is manufactured by burning sulphur in air or by roasting metallic sulphides like copper, iron or zinc.



### Physical Character :

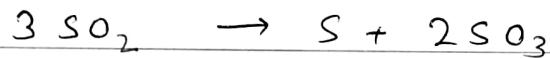
Sulphur dioxide is a colourless gas with a typical pungent smell of burning sulphur.  
 It condenses readily under pressure to a colourless liquid which boils at about  $-10^\circ$ .

Sulphur dioxide forms sulphurous acid in aqueous solution.

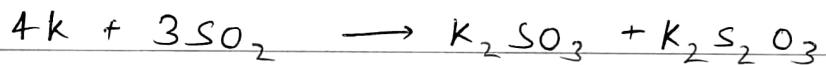
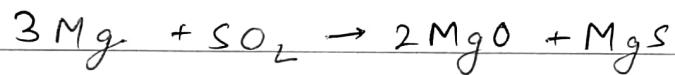


## Chemical Properties :

- Sulphur dioxide is decomposed into sulphur and sulphur trioxide when heated strongly.



- Sulphur dioxide is incombustible. However, strongly burning potassium or magnesium continues to burn in  $\text{SO}_2$  and decomposes it into sulphur and oxygen.



## Test for Purity :

Test for water; sulphuric acid and non-volatile residue. To determine non-volatile residue, a weighed sample is evaporated and the remaining matter is weighed.

## Incompatibility :

Under alkaline conditions, sulphur conditions, sulphur dioxide is converted to bisulphite and sulphate.

### Assay :

Sulphur dioxide is stable at moderate to strong acidic pH. As the pH becomes neutral to alkaline values, sulphur dioxide is converted into bisulphite and sulphite. This fact is used in the assay of  $\text{SO}_2$ .

### Uses :

Sulphur dioxide has antioxidant and antimicrobial properties and is used as a preservative for food.

In industry it is used for bleaching, wood pulp, fumigating grains and arresting fermentation.

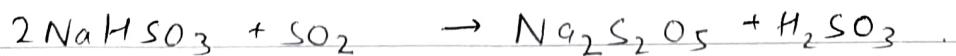
### \* Sodium Bisulphite

Chemical formula :  $\text{NaHSO}_3$

Mol. Weight : 104

### Preparation :

Sulphur bisulphite is prepared by passing sulphur dioxide into a solution of sodium carbonate until the solution is saturated. Evaporation of the solution gives a mixture of sodium bisulphite and metabisulphite.



### Physical Character :

Sodium bisulphite is a white or yellowish white crystalline powder having pungent odour of burning sulphur and disagreeable taste.

### Chemical Properties :

On exposure to air it is unstable, loses some  $\text{SO}_2$  and is generally oxidized to sulphate. It is soluble in cold water (2 in 3.5) and alcohol (1 in 70). Its aqueous solution is acidic. It is kept in well-closed containers and in a cool place.

### Test for Purity :

Tests for arsenic ; heavy metals ; and iron.

### Assay :

The assay is dependent on iodimetric titration. The substance is allowed to react with iodine.

### Uses :

Sodium bisulphite acts as a disinfectant, antioxidant and bleaching agent, particularly for wool; as antiseptic in fermentation industries; as preservative and bleach in food.

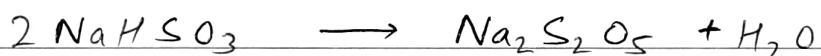
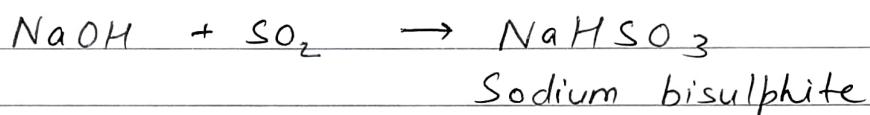
## \* Sodium Metabisulphite

Chemical formula :  $\text{Na}_2\text{S}_2\text{O}_5$

Mol. Weight : 190.10

### Preparation :

It is prepared by saturating hot, concentrated sodium hydroxide solution with sulphur dioxide. Cooling of the solution yields the salt.

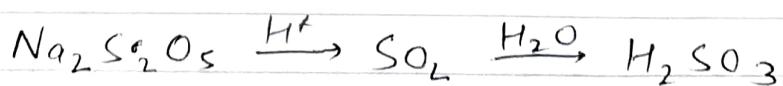


### Physical Characters :

It occurs as colourless or white prismatic crystals or a white or yellowish crystalline powder.

### Chemical Properties :

When an acid is added to a solution of sodium metabisulphite,  $\text{SO}_2$  gas is formed which is dissolved in solution as sulphurous acid (a solution of  $\text{SO}_2$  in water).



### Test for purity :

Tests for acids; arsenic; lead; heavy metals; and thiosulphate.

### Incompatibility :

The bisulphites of alkaline earth metals are less soluble and their sulphites are insoluble. Only alkali metal salts are soluble.

### Assay :

Like sulphur dioxide, sodium bisulphite and sodium metabisulphite are assayed on the basis of reducing a 0.1 N iodine solution which is added to the solutions in excess.

The residual iodine is titrated against sodium thiosulphate to determine the amount reduced by the metabisulphite.

### Uses :

Sodium metabisulphite is a strong reducing agent and is used as an antioxidant in pharmaceutical preparations to stabilize injections containing salts of adrenaline, atropine and sodium salicylate possessing phenol or catechol nucleus.

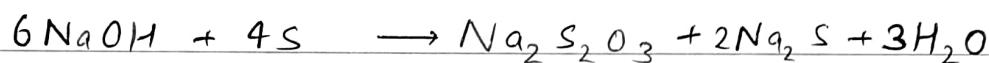
## \* Sodium Thiosulphate

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

Mol. Weight : 248.17

### Preparation :

Sodium thiosulphate is also prepared by reacting sodium hydroxide with sulphur.



### Physical Character :

Sodium thiosulphate occurs as colourless, odourless, transparent crystals or a coarse crystalline powder; cooling bitter taste; efflorescent in dry air above  $33^\circ$ ; deliquescent in moist air.

### Chemical Properties :

In sodium thiosulphate sulphur occurs in two different oxidation states. The oxidized sulphur atom is in a +6 state resisting further oxidation. The remaining sulphur atom is in a zero oxidation state. Due to this property the compound acts as a reducing agent or as an antioxidant.

### Test for Purity :

Test for arsenic ; calcium ; heavy metals ; chloride ; sulphate ; sulphite ; and sulphide.

### Incompatibility :

It is incompatible with metal cations due to the precipitation of the metal thiosulphate.

In acid solution, these precipitates may darken due to the formation of the related sulphides.

### Assay :

The assay is based on iodimetric titration.

A weighed amount (0.8) dissolved in water (30ml) is titrated with 0.1 N iodine, using 3 ml of starch solution as indicator as the end point is obtained. Each ml of 0.1N iodine is equivalent to 0.02482 g of  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ .



### Uses :

Sodium thiosulphate is used as an antidote in the treatment of cyanide poisoning in combination with sodium nitrite. It has antifungal properties and is used to treat pityriasis versicolor.

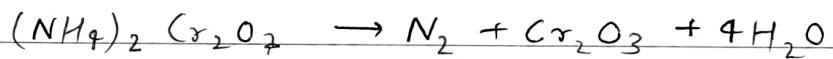
## \* Nitrogen

Chemical formula :  $N_2$

Mol. Weight : 28

### Preparation :

1. Nitrogen is manufactured by fractional distillation of liquid air.
2. Nitrogen is also formed when ammonium dichromate is heated.



### Physical Characters :

Nitrogen is a colourless, odourless and tasteless gas which is non-inflammable and does not support combustion.

### Chemical Properties :

Nitrogen neither burns nor support in burning. However, burning of magnesium and aluminium continues in an atmosphere of nitrogen forming nitrides.



Test for Purity:

Test for  $\text{CO}_2$ .

Uses:

Nitrogen is used as a diluent for pure oxygen or other active gases and as an inert gas to replace air in containers holding oxidisable substances, e.g. cod liver oil, olive oil, and multivitamin preparations.

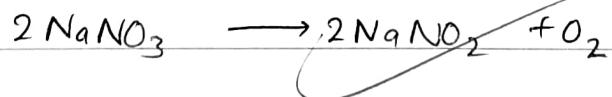
## ★ Sodium Nitrite

Chemical formula :  $\text{NaNO}_2$

Mol. weight : 69.0

Preparation:

Sodium nitrite is prepared by strongly heating sodium nitrate;

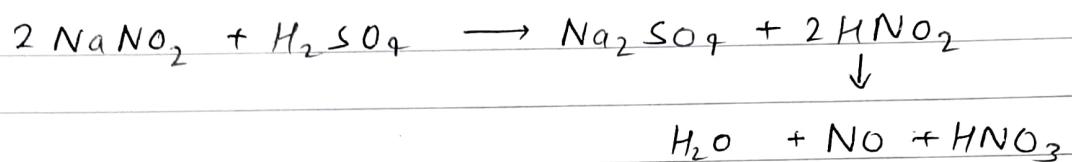


Physical Characters:

Sodium nitrite occurs as white or slightly yellow granular powder or fused masses or sticks; odourless; taste is saline; deliquescent; hygroscopic; very slowly oxidises to nitrite in air; m.p.  $271^\circ$ .

## Chemical Properties:

Sulphuric acid reacts with sodium nitrate solution forming nitrous acid.



## Test for Purity:

Test for heavy metals; chloride; sulphate; loss on drying.

## Incompatibility:

It is incompatible with acetanilide, antipyrine, phenazone, caffeine, citrate, chlorates, hypophosphites, iodides, mercury salts, etc.

## Assay:

The assay is based on oxidation reduction titration as discussed for hydrogen peroxide and ferrous sulphate.

## Uses:

Sodium nitrite is used in the treatment of cyanide poisoning in conjugation with sodium thiosulphate.