S.4 CHEMISTRY HOLIDAY WORK(SULPHUR AND CHLORINE)

TOPICAL OUTLINESULPHUR AND ITS COMPOUNDS

- Extraction of sulphur by Frasch Process
- Uses of sulphur
- Allotropes of sulphur
- Chemical properties of sulphur
- Preparation hydrogen sulphide
- Physical properties of hydrogen sulphide
- Chemical properties hydrogen sulphide
- Chemical test for hydrogen sulphide
- Preparation of sulphur dioxide
- Physical preparation of sulphur dioxide
- Chemical properties of sulphur dioxide
- Chemical test for sulphur dioxide
- Manufacture of sulphuric acid by Contact process
- Physical properties of concentrated sulphuric acid
- Chemical properties of sulphuric acid (dilute and concentrated)
- Uses of concentrated sulphuric acid
- Action of heat on sulphates
- Confirmatory test for sulphate ions and sulphite ions

TOPICAL OUTLINE FOR CHLORINE AND ITS COMPOUNDS

- Preparation of chlorine
- Physical properties of chlorine
- Chemical properties of chlorine
- Chemical test for chlorine
- Uses of chlorine
- Preparation of hydrogen chloride
- Physical properties of hydrogen chloride

- Chemical properties of hydrogen chloride
- Test for hydrogen chloride

EXTRACTION OF SULHUR

Sulphur is extracted by Fraschprocess .

Sulphur exists a free element in USA in sulphur deposits 200m below the ground.

In Frasch process, a hole of 30cm in diameter is made into the ground to sulphur deposits. Three concentric pipes (diameters 2 , 8 and 15cm)are introduced into the hole. Superheated water at 170^{o}C and at a pressure of 10atmospheres is forced down through the outer piperThe melting point of sulphur is 115^{o}C and the superheated water melts the sulphur.

Hot compressed air is forced down through the inner pipe and this forms a froth of molten sulphur and water and is forced out through the middle pipe. The mixture runs into large settling tanks where the sulphur solidifies to a yellow solid. The sulphur obtained by this process is 99% pure.

DIAGRAM OF FRASCH PROCESS

USES OF SULPHUR

- Sulphur is used in the vulcanization of rubber where raw rubber is heated with a calculated l amount sulphur and this makes rubber hard and strong.
- Sulphur is used in fireworks , gunpowder and match heads.
- Sulphur is used to sulphur ointment for treatment of ring worms.
- Sulphur is used to make tablets and drugs.
- Fruit trees are sprayed sulphur which kills insects and fungi which cause disease .
- Sulphur is used in the manufacture of sulphuric acid in contact process.

ALLOTROPIC FORMS OF SULPHUR

There are four allotropic forms of sulphur

- Rhombic sulphur
- Monoclinic sulphur
- Amorphous sulphur
- Plastic sulphur

The first **two** are **crystalline** while the **last two** are **non- crystalline**.

(a) Preparation of rhombic sulphur

Shake powered sulphur with carbon sulphide(solvent) until no more dissolves and the mixture filtered. The filtrate isput into a container which is covered with a paper with two holes in it. Carbon sulphide evaporates slowly . Bright yellow crystals form as a volatile solvent evaporates.

(b) Preparation of monoclinic sulphur

Place powdered sulphur in an evaporating basin which is warmed to melt the sulphur. More sulphur is added while being warmed until the basin is almost full of molten sulphur. Allow the sulphur to cool. When a thin crust forms over the surface, two holes are made in it . One hole lets molten

sulphur out into the beaker while the other hole lets in air. When the crust is removed, pale yellow needle like crystals form at bottom of the basin.

(c) Preparation of amorphous sulphur

Leave hydrogen sulphide solution in air for a day or two, white amorphous sulphur is slowly precipitated.

$2H_2S(aq) + O_2(g) \longrightarrow 2S(s) + 2H_2O(l)$

(d) Preparation of plastic sulphur

Boil sulphur and pour it in a thin continuous stream into a beaker of water. A yellow – brown elastic solid forms. It is called plastic sulphur.

DIFFERENCES BETWEEN RHOMBIC SULPHUR AND PLASTIC SULPHUR.

RHOMBIC SULPHUR	MONOCLINIC SULPHUR
Stable below 96^oC	Stable above 96^oC
Octahedral crystals	Needle like crystals
Bright yellow crystals	Pale yellow crystals
Melts at 113^oC	Melts at 120^oC
Density of $2.06gcm^{-3}$	Density of $1.96gcm^{-3}$

CHEMICAL PROPERTIES OF SULHUR

1. SULPHUR COMBINES DIRECTLY WITH SOME ELEMENTS

   (a) Reaction with iron

   A finely ground mixture of iron and sulphur is strongly heated in a hard test tube . There is a red glow and a black solid is formed which is iron(II) sulphide.

   $Fe(s) + S(s) \longrightarrow FeS(s)$

   (b) Reaction with copper

   When sulphur vapour is passed over heated copper, there a red glow and black solid of copper(I) sulphide is formed.

   $2Cu(s) + S(g) \longrightarrow Cu_2S(s)$

(c) Reaction with oxygen

When burning sulphur on a deflagrating spoon is lowered in a gas jar of oxygen , it continues to burn more bright blue flame forming white fumes.

$S(s) + O_2 \longrightarrow SO_2(g)$

$2S(s) + 3O_2 \longrightarrow 2SO_3(g)$

2. Reaction with concentrated acids

(a) Reaction with concentrated sulphuric acid

Sulphur dissolves in hot concentrated sulphuric acid and white fumes are formed.

$S(s) + 2H_2SO_4(l) \longrightarrow 3SO_2(g) + 2H_2O(l)$

(b) Reaction with concentrated nitric acid.

When warm concentrated nitric acid is poured on sulphur in an evaporating dish , there is effervescence of a brown fumes and a colourless liquid is formed.

$S(s) + 6HNO_3(l) \longrightarrow H_2SO_4(l) + 6NO_2(g) + 2H_2O(l)$

LABORATORY PREPARATION OF HYDROGEN SULPHIDE.

Hydrogen sulphide is prepared in the laboratory by dripping moderately concentrated hydrochloric acidthrough a dropping funnel onto iron(II) sulphide in a flat bottomed. There is immediate effervescence of a colouless gas and the gas is collected over warm water which dissolves out any fumes of hydrogen chloride .

If the hydrogen sulphide is required dry , the gas is passed through a wash bottle containing water to remove hydrogen chloride fumes and it is then passed through a u- tube containing anhydrous calcium chloride to dry the gas and is collected by down water delivery since it is denser than air.

$$FeS(s) + 2HCl(aq) \longrightarrow FeCl_2(aq) + H_2S(g)$$

DIAGRAM OF APPARATUS FOR THE PREPARATION OF HYDROGEN SULPHIDE

(a) Wet gas

(b) Dry gas

PHYSICAL PROPERIES OF HYDROGEN SULPHIDE

(a) Hydrogen sulphide is a colourless gas

(b) It has a repulsive smell of rotten(bad) eggs

(c) It is denser than air

(d) It turns moist blue litmus paper pink

CHEMICAL PROPERTIES OF HYDROGEN SULPHIDE