

**Group 16 (6)** called “**chalcogens**” (“brass giver “)

**O**  $O_2(g)$  – Colourless, tasteless, odourless gas. Mp  $-183^\circ C$  – paramagnetic .

$O_3(g)$  – ozone, blue gas, fresh smell. Mp  $-111^\circ C$

**S** :Yellow powder

- tasteless and odourless. Commonest allotrope is rhombic sulphur .

Takes form of  $S_8$  rings in rhombic sulfur.

Allotropes depend on ring stacking.

- Example of catenation in polysulfanes  $HS-S_x-SH$  where  $x = 0$  to 6.

**Se**: Grey non-metallic solid, poor electrical conductor, several allotropes consisting of chains.  $Se_8$  red solid .

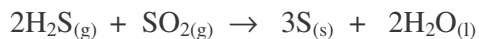
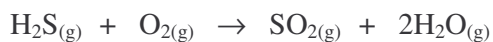
**Te** : Silver –white metalloid .

**Po** : Grey metalloid which is obtained from U and Th .

**Sulfur :**

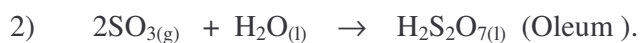
Source from sulfide ores e.g.  $FeS_2$  (fool’s gold ), mined by the “Frasch process” but also obtained from  $H_2S$  which occurs in oil by “Claus process“.

**Claus Process :**



**Use :** To strengthen rubber, a process called “vulcanisation“. Also to produce  $H_2SO_4$

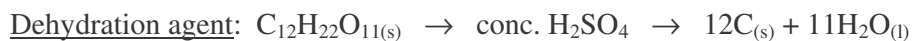
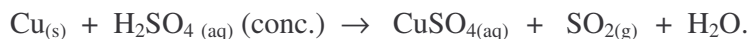
by the “**Contact Process**” which has 3 steps



**Dihydrogen sulfate** is an oily liquid with boiling point 300°C.

Bronsted acid : - almost completely dissociated in water .

Good oxidising agent :



Uses include the manufacture of ammonium sulfate – for use as a fertiliser, petrochemicals, dyestuffs, detergents .

**Sulfur compounds containing oxygen** :

$\text{SO}_2_{(g)}$  odourless poisonous gas, 84% occurs naturally – volcanic combustion, oxidation of  $\text{H}_2\text{S}_{(g)}$  – vegetation.

16% from industry – oil and coal combustion.

$\text{SO}_2$  is the acid anhydride of  $\text{H}_2\text{SO}_3$  “sulfurous acid”. Actually “ $\text{H}_2\text{SO}_3$ ” on cooling exists as  $\text{SO}_2 \cdot x\text{H}_2\text{O}$  ( $x = 7$ ), this is an example of a *clathrate*

$\text{H}_2\text{SO}_3$  is a source of  $\text{SO}_3^{2-}$  .

These ions can act as oxidising agents e.g  $\text{SO}_3^{2-}_{(aq)} + \text{S}_{(s)} \rightarrow \text{S}_2\text{O}_3^{2-}_{(aq)}$

(thiosulfate)

## Group 17 (7)

Halogens (“salt making “):

F (fluorine ), Cl (chlorine ), Br (bromine ), I(Iodine), At (astatine).

### Properties

**Decreasing** going down the group:

electronegativity, electron affinity (diatomic molecules ), oxidising ability

**Increasing** down the group:

Mp/Bp (London forces depend on number of electrons ), atomic /ionic radii, metallic character .

They have an electron configuration  $ns^2np^5$  - all require one electron for a complete stable octet.

The normal form of these elements is as diatomic molecules.

Interhalogen compounds occur when the gases react with each other. The stoichiometry depends on the relative sizes of the components e.g  $IF_7$  ,  $IBr$

( note that  $IF_7$  disobeys octet rule).