

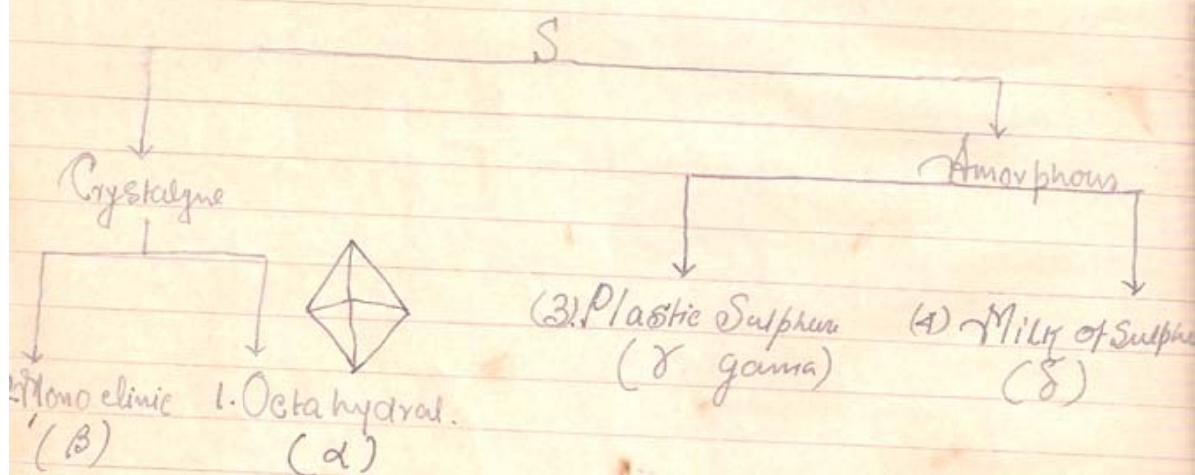
Sulphur



Q. Define allotropy? What are the allotrops of Sulphur. How are they prepared. Discuss their difficult physical properties. Prove that all the allotropic forms of sulphure contain Sulphur.

MS
Definition: Discussed

Allotrops of Sulphur:



Preparation of α Sulphur: ~ Sulphur obtained from earth is purified by distillation. This pure Sulphur which is marketed in the form of rolls is α Sulphur.

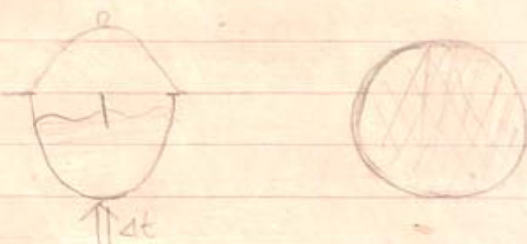
Physical properties:

It is soluble in CS_2 , C_6H_6 , $CHCl_3$ but insoluble in H_2O . It is non conductor of electricity and heat. M.P. = $113^\circ C$, (B.P. = $444^\circ C$)
Sp. gravity 2.05 and its crystal is 8 faces. So it is Octahedral (Rhombohedral Sulphur). It is transparent and light yellow in colour.

Sulphur



Mono clinic :- Ordinary Sulphur is taken in a Crucible, melted and allowed to cool slowly to form a solid crust (→) on the surface. Now with a glass rod the crust is punched (broken) and the still liquid portion is taken out. Long needle like Crystals of Sulphur are deposited at the bottom of the crucible.



Properties: It is brittle, transparent, light yellow colour. Specific gravity 1.93 M.P = 120°C . It is unstable and goes back to ordinary Sulphur after two or three days.

PLASTIC SULPHUR :- Let us take Ordinary Sulphur in a hard glass test tube and heat it, it melts at 113°C . Heating is continued till it begins to boil (444°C). Now pour this boiling liquid in a thin stream into cold water () in a beaker. The substance solidified and becomes similar to rubber pipe this is called plastic Sulphur.



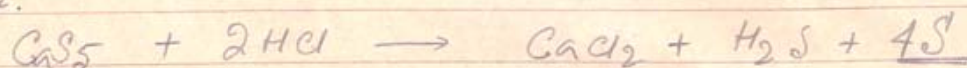
Properties :- It is Elastic and can be pressed by finger and can be thread. It is not Crystalline, Sp. gravity 1.95. Amber colour not soluble in water and insoluble in CS_2 . On keeping long time it goes back

Sulphur



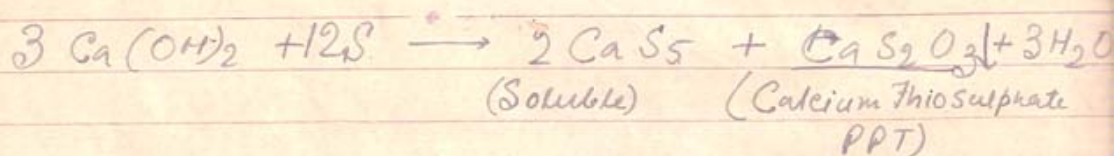
to Rombic Sulphur (α).

Milk of Sulphur: \sim (δ) When Calcium penta Sulphide (CaS_5) is treated with HCl we get small particles of Sulphur known as milk of Sulphur.



H.

This CaS_5 is prepared by heating ordinary Sulphur and Ca(OH)_2 .



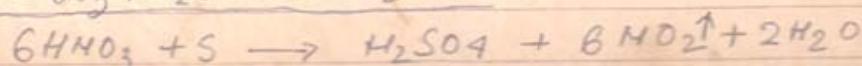
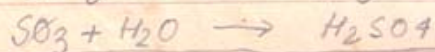
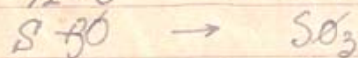
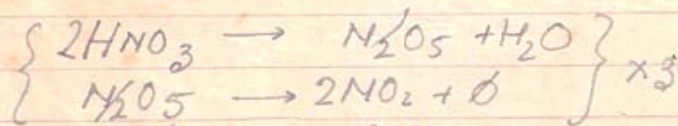
Properties: It is milk like to look at. $\text{SP} = 1.82$ insoluble in water but soluble in CS_2 . It goes back to ordinary Sulphur on heating. It is used in medicine.

15/4/87

Prove that ~~it~~^{allotrop.} contains Sulphur:

Qr. Prove that allotrops of Sulphur contains S.

In a small beaker 1 gm of any form of Sulphur is (Say α) dissolved with Conc. HNO_3 with one drop of Br_2 as a catalyst to get a solution of H_2SO_4 .

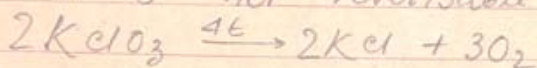




Distinction between decomposition and dissociation

Decomposition

The action is one sided that is not reversible.

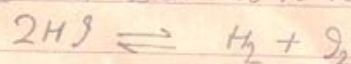


2. Presence of one of the product does not affect the reaction

3. Removal of one of the product does not affect the reaction.

Dissociation

The action is both sided. that is reversible.



The presence of one of the products affect the rate of chemical reaction.

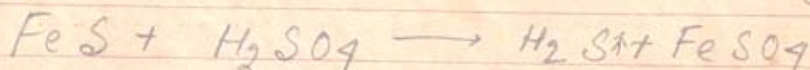
Removal of one of the product affect the reaction.

Q. SULPHURATED HYDROGEN.

How is hydrogen Sulphide / Sulphurated Hydrogen or Hydro Sulphuric acid prepared in the lab. in fairly pure form, Why HNO_3 is not used for the preparation of H_2S . Discuss its reaction with (i) NaOH (2) $\text{KMnO}_4 + \text{H}_2\text{SO}_4$ (3) $\text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4$ (4) FeCl_3 (5) Br_2 (6) $\text{CuSO}_4 \text{ sol}^n$ (7) $\text{Pb}(\text{NO}_3)_2 \text{ sol}^n$ (8) ZnSO_4 alkalyfied.

Discuss the uses of H_2S in the lab.

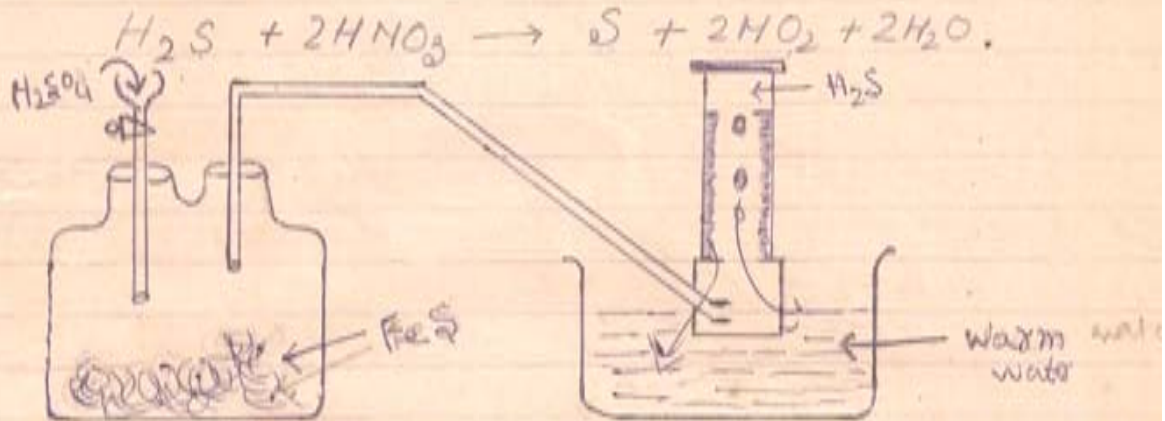
Theory :- When Ferrous Sulphide is treated with dilute H_2SO_4 in the Kipp's apparatus/wolf bottle we get Sulphurated hydrogen gas.



Sulphur



N:B Instead of H_2SO_4 we may use HCl but we can not use HNO_3 because it reacts with H_2S giving S so it is never used.



Procedure: To prepare small quantities of H_2S in the lab. we may use wolff's bottle although it is ready made prepared by Kipp's apparatus. About 50 gms of FeS (solid) is taken in a wolff's bottle which is fitted as shown in the figure with a delivery tube and ^(dropper) this funnel.

On adding dilute H_2SO_4 into it, at room temperature we get H_2S gas this gas is collected either by upward displacement of air or by downward displacement of warm water.

Purification: Precaution: Since it is slightly soluble in cold water, warm water is use for collecting this gas.

Purification: It is purified by passing through either either fixed $CaCl_2$ / P_2O_5 and it may be collected by displacement of Mercury.

N:B:- To get pure H_2S we may used antimony sulphide & conc. HCl

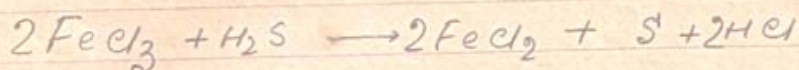
$$Sb_2S_3 + 6HCl \xrightarrow{4t} 3H_2S + 2SbCl_3$$

(in a round bottom flask)

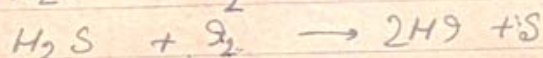
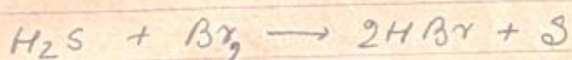


important

4. With FeCl_3 : On passing H_2S through FeCl_3 (yellow) we get FeCl_2 colourless.

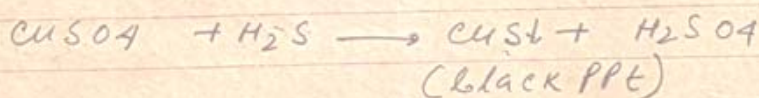


5. With $\text{Br}_2 / \text{Cl}_2 / \text{I}_2$: ~ It gives respective acid.

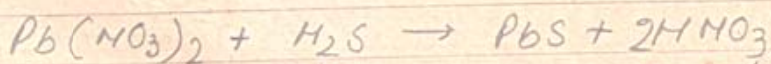


Iodine suspended in water.

6. With CuSO_4 solⁿ: On passing H_2S through CuSO_4 solⁿ blue we get black ppt of CuS .

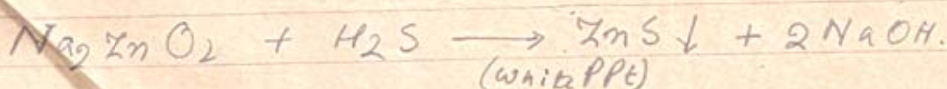
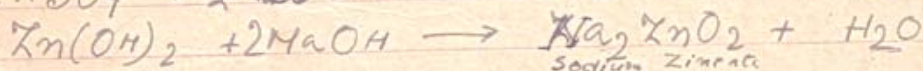


7. With lead nitrate $\text{Pb}(\text{NO}_3)_2$: On passing H_2S through lead nitrate solⁿ we get black ppt of PbS .



W.H
PPT

8. With ZnSO_4 (alkalified): When H_2S gas is bubbled through ZnSO_4 solⁿ / any Zinc salt solⁿ alkalified with NH_4OH or NaOH we get white ppt of ZnS .



N.B.

In HCl medium we can not get ppt.

Sulphur



With SO_2 : When both this gases passed in water

$$2\text{H}_2\text{S} + \text{SO}_2 \rightarrow 2\text{H}_2\text{O} + 3\text{S} \downarrow$$
 S is precipitated. Water is the medium.

(10) Wet test for Basic Radical

F.e Separation of Cation in Groups.

Group	Reagent	PPT colour.
I	dilute HCl	Pb^{++} (white)
II	dilute HCl + H_2S	Cu^{++} (black), Pb^{++} (black)
III A	NH_4Cl + NH_4OH (solid) (excess)	White (gelatinous) Al^{+++} Brown $\rightarrow \text{Fe}^{+++}$ green $\rightarrow \text{Cr}^{+++}$
III-B	NH_4Cl + NH_4OH + H_2S (e)	Zn^{++} , Mn^{++} (white), (flesh colour) Co^{++} (black)
IV	(Froash) NH_4Cl + NH_4OH + $(\text{NH}_4)_2\text{CO}_3$ (e)	Ba^{++} (white), Ba^{++} (white), Sr^{++} (white)
V	Individual reagent	K^+ , Na^+ , NH_4^+ , Mg^+



Uses of H_2S :-

To detect

1) H_2S is used to detect the basic radical in the salt test.

As for example: When H_2S gas is passed through lead salt solⁿ / Cu salt solⁿ we get black ppt. If the original salt is white it should be lead and if the original salt is blue it should be Cu.

2. To separate into groups if two salt mixture is given.

As for example: If we are given Copper salt (II group) and Al salt IIIA mixture is given we are to make a solⁿ of the mixture then add dilute HCl and H_2S is passed to get black ppt of CuS which is filtered out. So in the filtrate Al salt will remain. To this we are to add NH_4Cl and NH_4OH excess to get gelatinous ppt of $Al(OH)_3$.

3. To classify into groups :-

As for example: In acid medium / HCl medium passing H_2S II group salt ppt are obtained.

By passing H_2S in alkaline medium / NH_4OH we get III B group PPT.

In a nutshell it is used for detection, separation and classification of metallic ions in salt test.



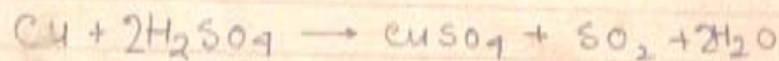
Q. How is SO_2 prepared in lab. in dry and pure form what byproduct you can expect and prepare from it.

Why the atmosphere inside the R.B flask becomes foggy at the beginning. Why the byproduct is a bit blackish. Discuss the chemical properties prove that SO_2 contain S.

In a tubular form distinguish the bleaching action of SO_2 and Cl_2 . What do you mean by antichlor. (H_2O_2 is the antichlor to remove excess Cl_2 of the bleached cloth)

ANS: Preparation of SO_2 :

Theory: When Conc. H_2SO_4 and Cu turnings are heated in a round bottom flask we get SO_2 .



Procedure.

In a round bottom flask about 20 gms of copper turnings is taken. It is fitted with a thistle funnel through which about 50cc of Conc. H_2SO_4 is poured into the flask. It is fitted with a delivery tube as shown in the

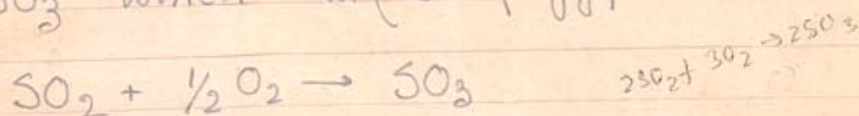
On heating the mixture a foggy atm. is formed inside the R.B flask (SO₂) so after lifting two or three gas less than that gas is collected.



Precaution:- At first the gas is not collected till the foggy atmosphere inside is removed.

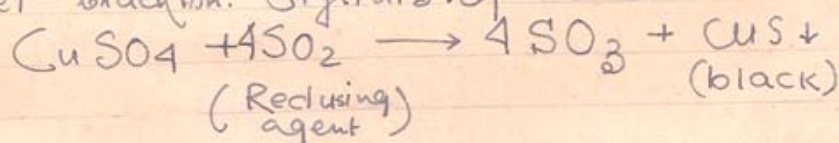
Purification: This gas is dried by passing through Conc. H_2SO_4 taken in wash bottle. And then collected by downward displacement of Hg.

Reason of foggy atm. :- SO_2 reacts with Oxygen present inside the round bottom flask causing SO_3 which makes foggy inside the flask.



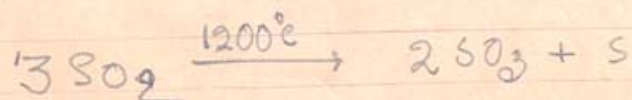
Byproduct: After getting SO_2 we are left with unreacted copper and $CuSO_4$ solⁿ. It is removed and filtered. The filtrate on evaporation gives blue crystals of $CuSO_4 \cdot 5H_2O$ which are filtered and submitted.

Why becomes black: $CuSO_4$ is blue but it is always reduced into CuS partially which is black therefore instead of getting blue crystals we get blackish crystals.



To prove that SO_2 contain S :-

When SO_2 gas is subjected to electric spark $1200^\circ C$ or subjected to strong beam of light it breaks into SO_3 and yellow particles of Sulphur.

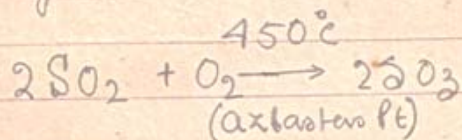




v. CONTACT PROCESS: for the preparation of H_2SO_4

- (a) Prove that H_2SO_4 is an oxidising agent.
 (b) is a dibasic acid.
 (c) has affinity for water.
 (d) Contains H , S and O .

Theory: SO_2 reacts with O_2 at about $450^\circ C$ in the presence of platinised asbestos to give SO_3 this SO_3 on being treated with water gives H_2SO_4 .

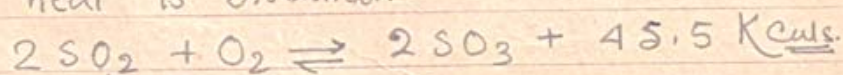


materials required:

1. SO_2 from Iron pyrite.
2. H_2O
3. O_2 (air)
4. Platinized asbestos.

Condition of Experiment:

- (1) SO_2 and air mixture must be free from dust particles or arsenic As_2O_3 because they are extremely poisonous for the costly Catalyst.
2. Temperature kept at $450^\circ C$ as it is exothermic reaction and reversible. Once heating the Catalyst no further heat is essential.

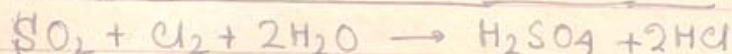
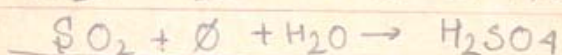
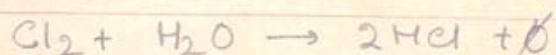


3. Excess of O_2 to ensure complete conversion of SO_2 into SO_3 .

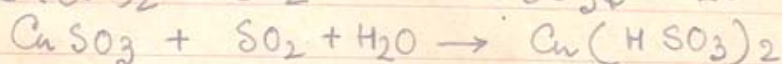
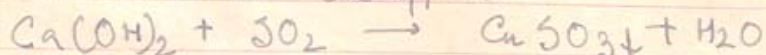
Sulphur



(5) With Chlorine water: Chlorine with water gives nascent Oxygen and this nascent Oxygen helps to convert SO_2 into H_2SO_4 .



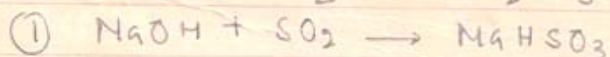
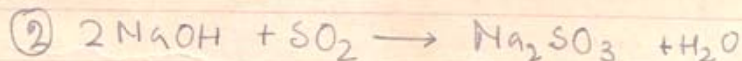
(7) lime water: $\text{Ca}(\text{OH})_2$: When SO_2 is passed through lime water a insoluble CaSO_3 is formed which turns lime water milky and on passing excess of SO_2 the milkiness disappears.



(8) With H_2S : When SO_2 and H_2S gas are mixed in water medium S is precipitated.



(9) With NaOH : ~ When SO_2 reacts with NaOH it gives sodium bisulphites however with excess NaOH it gives sodium Sulphites.





v. CONTACT PROCESS: for the preparation of H_2SO_4

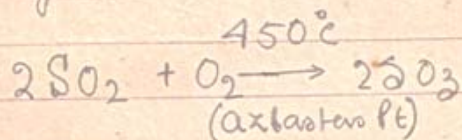
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materials required:

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2. H_2O

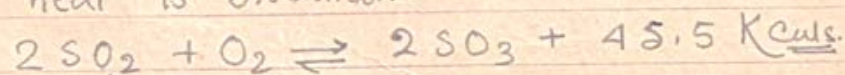
3. O_2 (air)

4. Platinized asbestos.

Condition of Experiment:

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3. Excess of O_2 to ensure complete conversion of SO_2 into SO_3 .

Sulphur



Procedure :- SO_2 and air obtained from \rightarrow

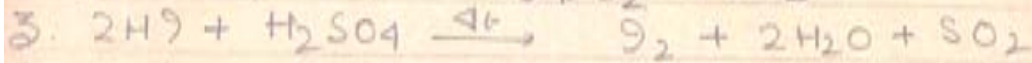
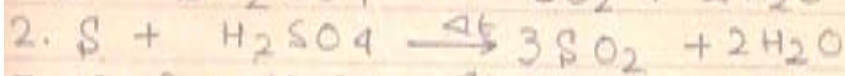
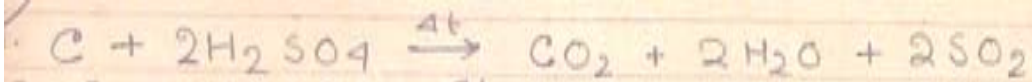
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rite box is washed with Steam, cooled by lead pipe washed with water and then dried by Conc. H_2SO_4 this is checked by tyndal box.

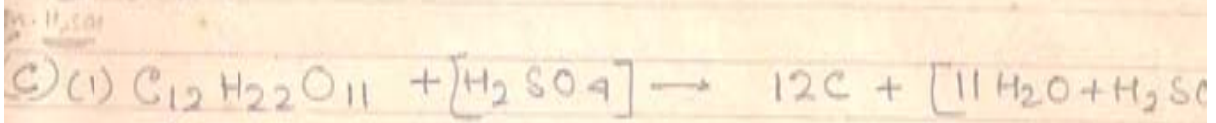
This SO_2 and air freed from impurities is passed in the Contact Chamber/furnace containing iron pipes packed with Platinised asbestos and heated at 450°C . Here SO_3 is formed. This is passed into a tank containing 98% H_2SO_4 , the water of which reacts with SO_3 producing H_2SO_4 therefore stream of water is run into the tank at such a rate that the strength of the acid is always maintained 98%.

OLEUM: Excess of SO_3 is passed into 100% H_2SO_4 / 100% H_2SO_4 to get fuming H_2SO_4 known as Oleum.

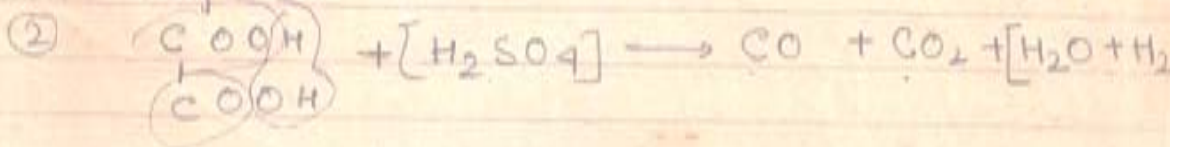
Sulphur



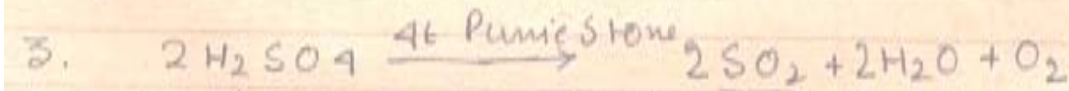
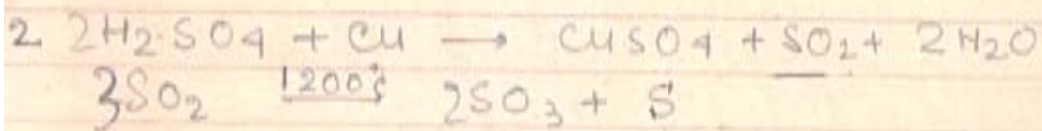
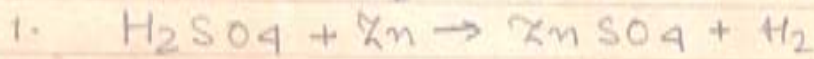
It forms Na_2SO_4 and $NaHSO_4$ One is normal salt and other is an acid salt only so it is dibasic.



Sugar



(B) CONTAINS H_2 :



SO_2 is condensed in 'U' tube then the left gas is O_2 .

